Mackenzie Mountain Non-resident and Non-resident Alien Hunter Harvest Summary 2013

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ABSTRACT

Each of the eight licenced outfitters and Renewable Resource Officers with the Sahtu and Dehcho Environment and Natural Resources (ENR) regional offices collected data on big game harvested in the Mackenzie Mountains during the 2013 hunting season. Harvest data and observations of wildlife from non-resident and non-resident alien hunters (collectively called 'non-resident' for this report) were recorded. For 2013, 401 hunters bought non-resident licences. This is higher than the average 368 (range 321-407) sold to non-resident hunters from 1991-2013, but similar to sales over the past nine years. Hunters (n=303) from outside Canada (non-resident aliens) were primarily from the USA (n=236) and comprised 59% of the outfitted hunters; 22 and seven hunters were from Germany and Belgium respectively, with six hunters coming from both Austria and Australia. There were 98 (24%) Canadian hunters, whose residency was from outside the Northwest Territories (NWT); of these, 87 were from Alberta (AB) or British Columbia (BC). Of the 401 non-resident licence holders, 368 came to the NWT and most spent at least some time hunting.

Two-hundred and sixty-four tags were purchased for Dall's sheep; 193 rams were harvested (including eight by resident hunters). The average annual ram harvest over the past 23 years was 197. The mean (±SD) age of harvested rams was 10.5±1.5 years; the fourth highest average age since records have been kept (1967), and the 26th consecutive year the average age of harvested rams from the Mackenzie Mountains has been ≥9.5 years. The average right horn length was 87.5 cm with the percent of broomed horns considerably lower than average. Hunters reported seeing fewer legal rams (horns at least ¾ curl) than rams with horns <¾ curl during their hunts, average six legal rams/hunt. Based upon hunter observations we estimated 51.8 lambs and 92.3 rams per 100 ewes, respectively. In 2013, 296 tags were purchased for

northern mountain caribou, the third highest since reporting started in 1991. The harvest of 182 bull caribou was the third highest reported and higher than the average of 160 (range 117-191) from the past 23 years. Hunters observed an estimated 36.3 caribou calves and 42.9 bulls per 100 adult female caribou, respectively.

One hundred and thirty-one tags were purchased for moose this year, the greatest number in any year. The harvest of 81 bull moose was the second highest since reporting started in 1991. Hunters observed an estimated 29.5 moose calves and 106.1 bulls per 100 adult female moose, respectively. From 2004-2012, the cow:calf ratio was $\geq$30:100.

This year 58 tags were purchased for mountain goats; the highest number of tags purchased and considerably higher than the average of 45 tags purchased for last nine years. Eleven goats (ten males, one female) were harvested, the fewest in the past eight years. Mean age of ten goats, determined by horn annuli, was 8.2 years (range 5.5-11.5 years). Hunters observed an estimated 69.6 goat kids and 75.0 billies per 100 adult nannies.

Regarding carnivores: sixteen wolves were harvested from 299 tags purchased, including four harvested during the winter season in zone S/OT/01. The harvest of 16 wolves in 2013 is similar to the average of 15 annually since reporting started in 1991. Hunters observed 155 wolves in 2013 (range 142-317 observed annually 1995-2012). Two wolverines were harvested from 155 tags purchased in 2013. Hunters observed 17 wolverines in total including one pair. No black bears were harvested from 34 tags purchased. Only five black bears have been harvested in the Mackenzie Mountains since 1991. This year more black bear cubs were observed than in any year since reporting began in 1995 and black bears were observed north of

64°N latitude. There has been no grizzly bear hunting season for non-residents since 1982. Two nuisance grizzly bears were killed this year.

Hunter satisfaction remains high; 97% of respondents (n=207) rated their experience as either excellent (86%) or very good (11%). The high quality hunting experience, the abundance of wildlife in the Mackenzie Mountains (both game and predators), and the impressive management and stewardship of the land were specifically commented on. Repeat clients (23% of respondents) had returned for a 2nd to 25th hunt, and 92% of respondents indicated they would like to return in future years. Disappointingly, we received only 56% of the voluntary hunter observation forms, returning to pre-2004 levels. An additional 5% of the hunter observation forms were lost prior to submission. However, the new reporting system we designed with the Association of Mackenzie Mountain Outfitters (AMMO) for summarizing wild game meat records continues to work extremely well. This is the third year in a row we have been able to summarize information about meat distribution for all eight outfitters. We estimated a minimum of 22,895 kg (50,369 lbs.) of wild game meat, mostly moose and mountain caribou, was distributed locally this year. Replacement cost of meat from local northern retailers is conservatively estimated at $572,375 using $25/kg average replacement cost. Although the boundaries of Nahanni National Park Reserve (NNPR) were substantially expanded in 2009, affecting outfitting zones D/OT/01, D/OT/02, and S/OT/03, until negotiations between these outfitters and Parks Canada are completed, ENR will continue to issue licences, tags, and export permits for harvesting big game by these three outfitters in their zones. The prevalence of *Trichinella* spp. in wolves from the Mackenzie Mountains (86%) was higher than in wolves from the Dehcho. No *Trichinella* spp. were detected in cohabiting large mammal prey species.

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INTRODUCTION

General Background

The 140,000 km^2 (54,000 mi^2; 34.6 million acres) area of the Mackenzie Mountains in the western Northwest Territories (NWT) was first opened to non-subsistence hunters in 1965 (Simmons 1968). Since then, the Mackenzie Mountains have become world-renowned for providing a high quality wilderness hunting experience (www.spectacularnwt.com/whattodo/hunting/themackenziemountains, www.huntingreport.com, Veitch and Simmons 1999), particularly for Dall's sheep and more recently moose. In return, non-resident hunters and outfitters in the Mackenzie Mountains provide about $2.5 million annually to individuals, businesses, and governments in the NWT (Harold Grinde, personal communication). The outfitted hunting industry in the Mackenzie Mountains also provides employment for 150-170 outfitters, guides, pilots, camp cooks, camp helpers, and horse wranglers (Werner Aschbacher, personal communication). In addition, fresh meat from many harvested animals is provided to a number of local communities including Tulita, Fort Good Hope, and Norman Wells in the Sahtu and Wrigley, Nahanni Butte, Fort Liard and Fort Simpson in the Dehcho. This meat is distributed among local elders and residents and to health/long term care facilities. The estimated annual replacement value of this meat has ranged from *ca.* $60,000-$625,000.

Eight outfitters are currently licenced by the Government of the Northwest Territories (GNWT) to provide big game outfitting services within the Mackenzie Mountains (Figure 1, Appendix A). No hunting is permitted within the original boundaries of NNPR (Figures 1, 2) except for subsistence harvest by NWT General Hunting Licence (GHL) holders. Under the NWT *Wildlife Act*, each licenced outfitter has the exclusive privilege of providing services

within their zone, which enhances the outfitters' ability to practice sustainable harvest through annual allocation of the harvest effort.

The hunting licence year in the NWT runs from 01 July - 30 June and those who desire to hunt big game within the NWT must annually obtain a big game hunting licence and must be at least 16 years old (Environment and Natural Resources 2013). There are four classes of licenced big game hunters in the NWT:

1) *General:* subsistence harvesters, primarily Aboriginal people.

2) *Resident:* Canadian citizens or landed immigrants who have been living in the NWT for at least two consecutive years prior to application for the licence.

3) *Non-resident:* Canadian citizens or landed immigrants who live outside the NWT, or have not resided in the NWT for a full two years prior to application for the licence.

4) *Non-resident Alien:* an individual who is neither a NWT resident nor a non-resident.

Both non-resident and non-resident alien hunters must use the services of an outfitter and must be accompanied by a licenced guide at all times while hunting big game. For simplification in this report, we call both non-resident and non-resident alien hunting licence holders 'non-residents' and combine their harvest statistics. The data from eight resident hunters, who harvested Dall's sheep in the Mackenzie Mountains without a guide, have been included in the number of sheep harvested and the age and horn length measurements in this report as indicated.

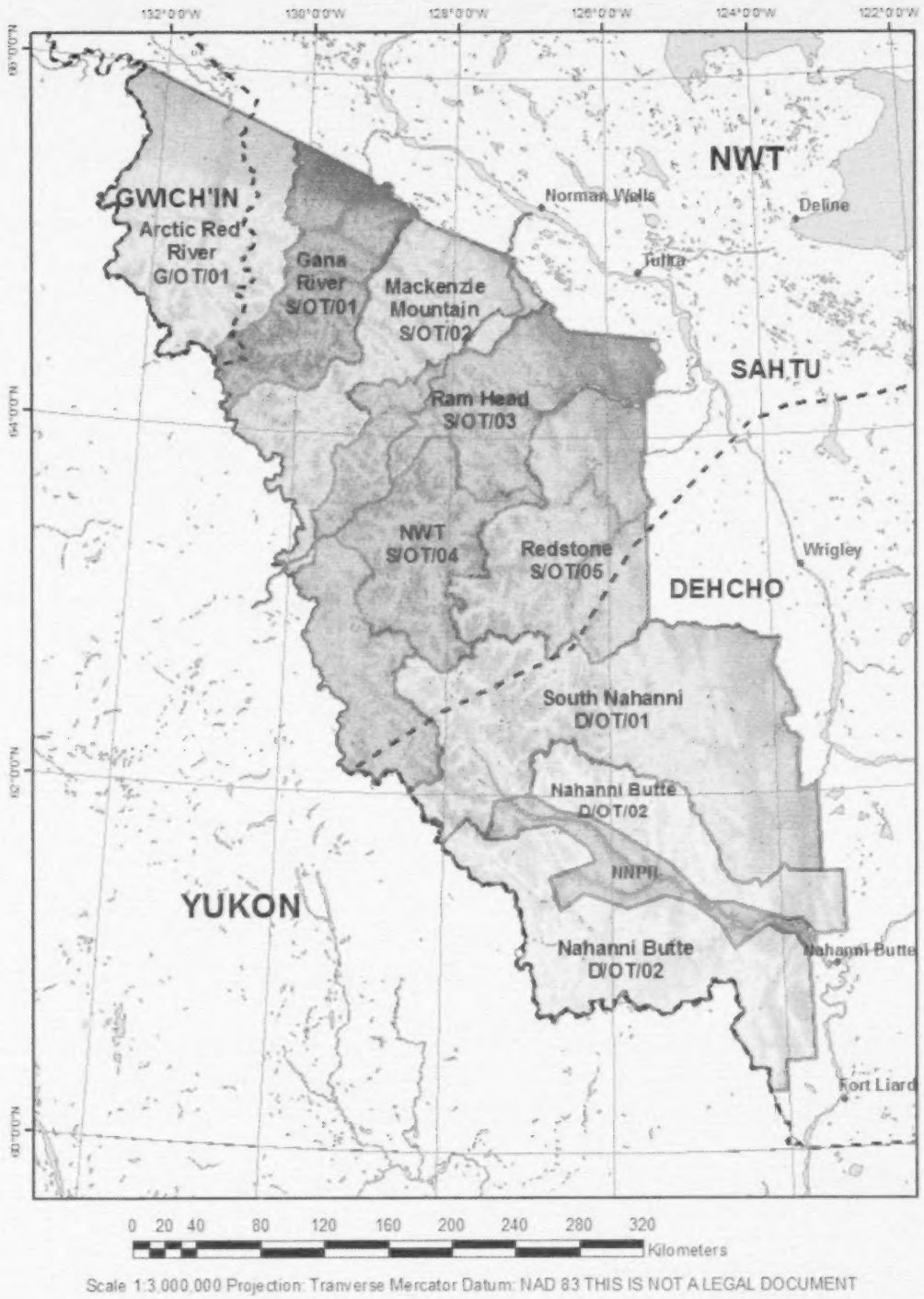

Figure 1: Outfitting zones and land claim areas (dotted lines) of the Mackenzie Mountains, Northwest Territories, with Nahanni National Park Reserve (NNPR) original boundary, prior to 2009 expansion, indicated.

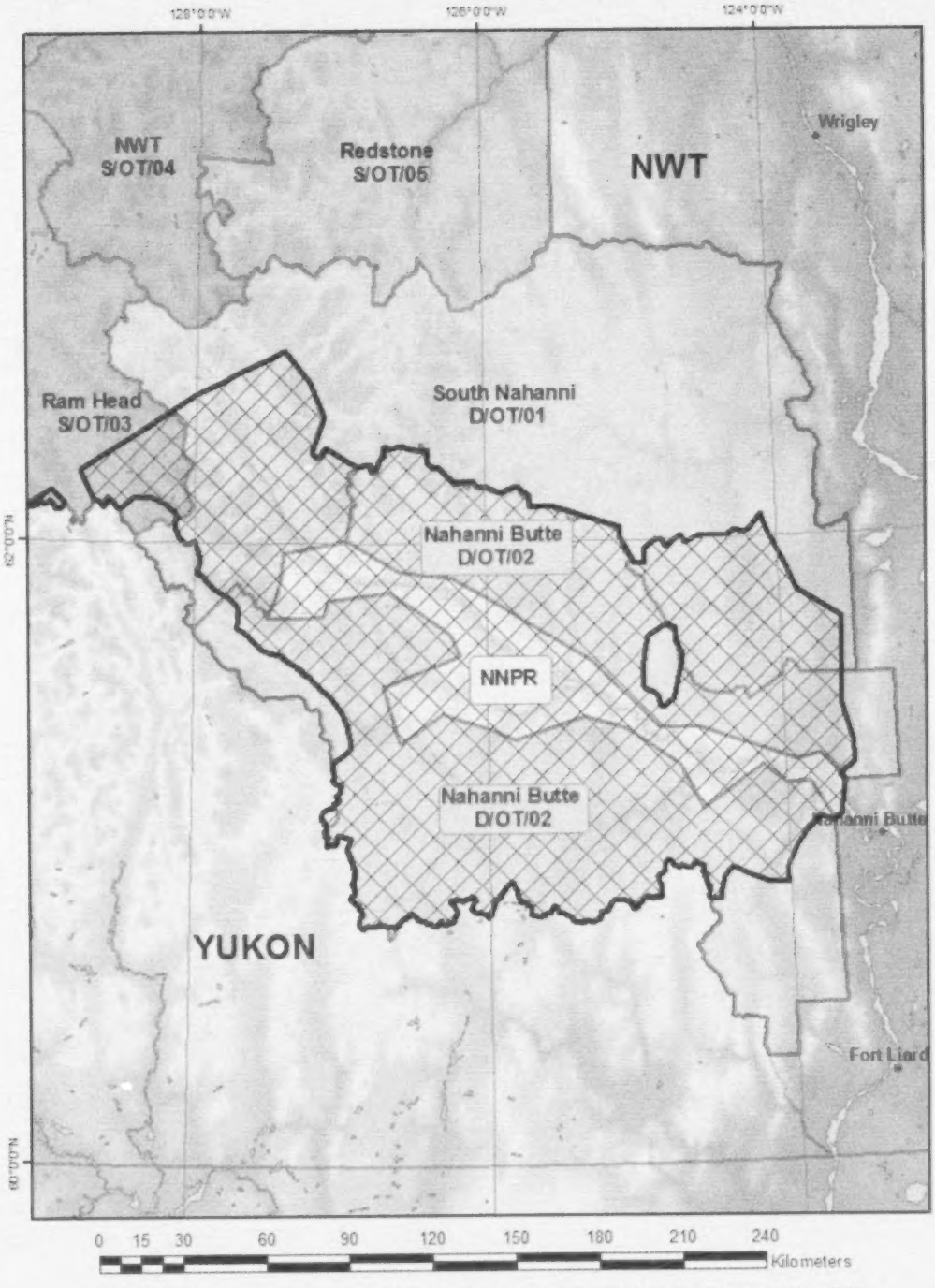

Figure 2: The original area of NNPR, in white, with the expanded boundary (9 June 2009) indicated by the checkered polygon.

Individual non-resident hunters are annually restricted to one each of the following big game species (Appendix B): Dall's sheep (male with at least one ¾ curl horn), northern mountain woodland caribou (either sex), moose (either sex), mountain goat (either sex), wolf (either sex)[1], wolverine (either sex), and black bear [adult not accompanied by cub(s)]. Although non-resident hunters are allowed to hunt female moose and caribou they prefer to hunt males for their trophy antlers and the harvest is exclusively males. Non-resident hunting for grizzly bears was closed in 1982 as a result of concerns about over-harvest (Miller et al. 1982, Latour and MacLean 1994). There are currently no restrictions on the total number of each big game species that an outfitter can take within the zone for which they are licenced.

Wildlife management within the Mackenzie Mountains is the responsibility of a variety of government agencies and boards set up as a result of comprehensive land claim agreements. The NNPR (4,766 km^2 original pre-2009 boundary) in the south Mackenzie Mountains is managed by Parks Canada – an agency of the Canadian federal government. Under the terms of the *Sahtu Dene and Métis Comprehensive Land Claim Agreement* (signed in 1993) and the *Gwich'in Comprehensive Land Claim Agreement* (signed in 1992), the main instrument of wildlife management within the two settlement areas lies with the Sahtu Renewable Resources Board (SRRB) and the Gwich'in Renewable Resources Board (GRRB), respectively. Approximately 68,000 km^2 of the central and northern Mackenzie Mountains are within the Sahtu Settlement Area and 8,300 km^2 are within the Gwich'in Settlement Area, which encompass the extreme north end of the range (Figure 1). However, the GNWT maintains ultimate jurisdiction for management of wildlife and wildlife habitat within each of the claim

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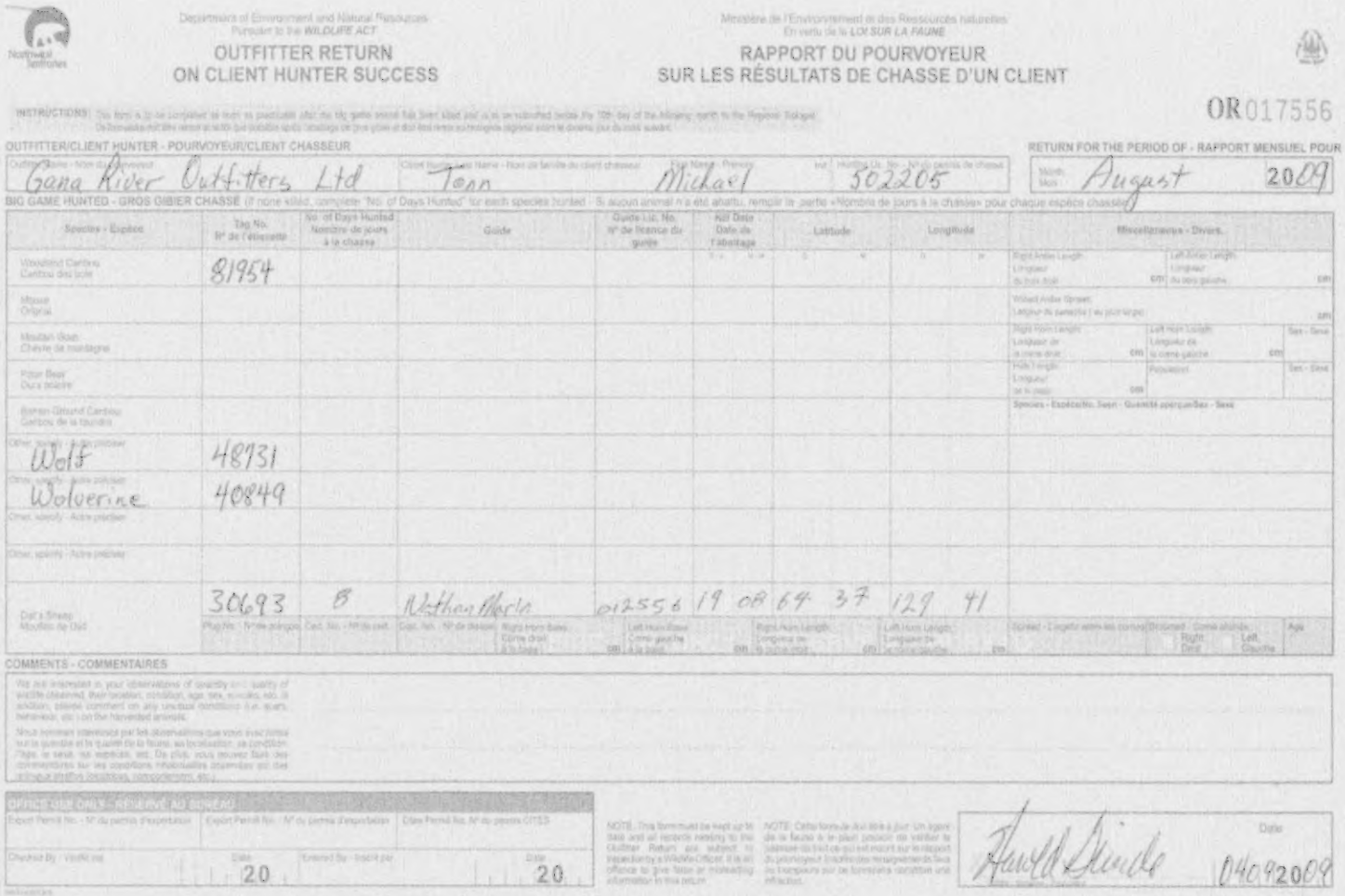
[1]In the Sahtu region, non-resident hunters and non-resident alien hunters are allowed to hunt two wolves from 1 August - 15 April.

areas. ENR is responsible for licencing outfitters, guides, and hunters and for annually monitoring non-resident big game harvest in the Mackenzie Mountains.

Each year ENR, under the *Wildlife Act* related provisions in the *Wildlife Business Regulations*, requires outfitters to submit an outfitter return on a client hunter success form for each person that purchased a NWT non-resident big game hunting licence (Figure 3). These are known as outfitter return forms and they must be submitted whether or not a client actually hunted, and whether or not any game was harvested. The outfitter return forms allow us to quantify harvest by non-resident hunters to help biologists with the GRRB, SRRB, and ENR to ensure that the harvest of each species is within sustainable limits.

In 1995, the then Department of Resources, Wildlife and Economic Development (RWED), requested that all non-resident hunters also fill out a voluntary questionnaire. The questionnaire has evolved through the years based upon suggestions from outfitters, their clients, and government staff. Different questions pertaining to wildlife observations, the quality of the hunting experience, the quality of services related to hunter travel, and specific topics for hunter comment have come and gone. However, one key component of the questionnaire that has remained constant pertains to reporting the different types and numbers of wildlife species seen during their hunts. These data have been recorded and the questionnaire forms have been referred to as hunter observation forms in this report (Figure 4). These data provide valuable time series of observations and are used in assessing mountain caribou herd status (Larter 2012a).



Department of Environment and Natural Resources
Pursuant to the *WILDLIFE ACT*

OUTFITTER RETURN
ON CLIENT HUNTER SUCCESS

Ministère de l'Environnement et des Ressources naturelles
En vertu de la *LOI SUR LA FAUNE*

RAPPORT DU POURVOYEUR
SUR LES RÉSULTATS DE CHASSE D'UN CLIENT

OR017556

INSTRUCTIONS: This form is to be completed as soon as practicable after the big game animal has been killed and is to be submitted before the 10th day of the following month to the Regional Biologist.

OUTFITTER/CLIENT HUNTER - POURVOYEUR/CLIENT CHASSEUR

Outfitter Name - Nom du pourvoyeur: Gana River Outfitters Ltd

Client Hunter's Last Name - Nom de famille du client chasseur: Tenn

First Name - Prénom: Michael

Hunting Lic. No. - No du permis de chasse: 502205

RETURN FOR THE PERIOD OF - RAPPORT MENSUEL POUR

Month - Mois: August 2009

BIG GAME HUNTED - GROS GIBIER CHASSÉ (If none killed, complete "No. of Days Hunted" for each species hunted - Si aucun animal n'a été abattu, remplir la partie «Nombre de jours à la chasse» pour chaque espèce chassée)

Species - Espèce	Tag No. N° de l'étiquette	No. of Days Hunted Nombre de jours à la chasse	Guide	Guide Lic. No. N° de licence du guide	Kill Date - Date de l'abattage	Latitude	Longitude	Miscellaneous - Divers
Woodland Caribou Caribou des bois	81954							Right Antler Length - Longueur du bois droit cm; Left Antler Length - Longueur du bois gauche cm
Moose Orignal								Widest Antler Spread - Largeur du panache / au plus large cm
Mountain Goat Chèvre de montagne								Right Horn Length - Longueur de la corne droite cm; Left Horn Length - Longueur de la corne gauche cm; Sex - Sexe
Polar Bear Ours blanc								Hide Length - Longueur de la peau cm; Pelt/skull; Sex - Sexe
Barren Ground Caribou Caribou de la toundra								Species - Espèce/No. Seen - Quantité aperçue/Sex - Sexe
Other, specify - Autre préciser Wolf	48731							
Other, specify - Autre préciser Wolverine	40849							
Other, specify - Autre préciser								
Other, specify - Autre préciser								
Dall's Sheep Mouflon de Dall	30693	8	Nathan Horla	012556	19 08	64 37	129 41	

Dall's Sheep / Mouflon de Dall — Plug No. - N° de plomb; Cert. No. - N° du certif.; Guid. Nat. - N° de dossier; Right Horn Base - Corne droit à la base cm; Left Horn Base - Corne gauche à la base cm; Right Horn Length - Longueur de la corne droit cm; Left Horn Length - Longueur de la corne gauche cm; Scored - L'objet a-t-il été mesuré; Broomed - Corne ébouée: Right - Droit, Left - Gauche; Age

COMMENTS - COMMENTAIRES

We are interested in your observations of quantity and quality of wildlife observed, their location, condition, age, sex, activities, etc. In addition, please comment on any unusual conditions (i.e. scars, behaviour, etc.) on the harvested animals.

Nous sommes intéressés par les observations que vous avez faites sur la quantité et la qualité de la faune, sa localisation, sa condition, l'âge, le sexe, les activités, etc. De plus, nous aimerions avoir des commentaires sur des conditions inhabituelles observées sur des animaux abattus (cicatrices, comportement, etc.).

OFFICE USE ONLY - RÉSERVÉ AU BUREAU

Export Permit No. - N° du permis d'exportation | Export Permit Iss. - N° du permis d'exportation | Date Permit Iss. N° du permis CITES

Checked By / Vérifié par | Date: 20 | Entered By - Inscrit par | Date: 20

NOTE: This form must be kept up to date and all records relating to this Outfitter Return are subject to inspection by a Wildlife Officer. It is an offence to give false or misleading information in this return.

NOTE: Cette formule doit être à jour. Un agent de la faune a le droit d'exiger de vérifier la véracité du fait ce qui est inscrit sur le rapport du pourvoyeur. Il est interdit de renseigner de faux ou trompeurs pour de fournir la déclaration une infraction.

Date: 04092009

Headquarters - Administration Centrale

Figure 3: Example of a completed outfitter return on client hunter success form.

MACKENZIE MOUTAINS, NORTHWEST TERRITORIES
HUNTER WILDLIFE OBSERVATION REPORT – 2007

Dear Hunter: The Department of Environment and Natural Resources request your kind assistance with completing this questionnaire about your NWT hunting experience, in order to assist us with the management of Mackenzie Mountain big game populations. All the requested information is completely voluntary, but your providing it to us is most appreciated.

HUNTER INFORMATION

Last Name	First Name and Initials	
CLIFFORD	GREGORY P.	
Address- number and street, box number	**Town, City**	**Province, State, Country**
14 SAGE ROAD	LANDER	WYOMING. USA

Hunting License # HL 715052 Outfitter Zone: G10T101 Outfitter: ARCTIC RED RIVER

Start Date of Hunt 7/15 2007 End Date of Hunt 7/24 2007 Observations Made Over 10 Days

ESTIMATED NUMBER OF DALL'S SHEEP SEEN			
¾ and Full Curl Rams	Less than ¾ Curl Rams	Ewes	Lambs
25	46	24	17

ESTIMATED NUMBER OF WOODLAND CARIBOU SEEN		
Bulls	Cows	Calves
2	1	Ø

ESTIMATED NUMBER OF MOOSE SEEN		
Bulls	Cows	Calves
Ø	Ø	Ø

ESTIMATED NUMBER OF MOUNTAIN GOAT SEEN			
Billys	Nannys	Kids	Unknown Age
Ø	Ø	Ø	Ø

Other Species						
	Wolf	Wolverine	Black Bear		Grizzly Bear	
			Adult	Cub	Adult	Cub
Number(s) Seen	3	Ø	Ø	Ø	1	Ø

How would you rate your overall hunting experience in the Mackenzie Mountains?
Excellent X Very Good _____ Good _____ Fair _____ Poor _____

How many times have you hunted in the Mackenzie Mountains, **including** this year's hunt? 2

Do you plan to return to hunt in the Mackenzie Mountains again? Yes X No _____

COMMENTS: Excellent Area / outfitter.

Thank You! Please give this form to the Officer or Clerk when you are exporting your trophies, or to the guide/outfitter with whom you hunted. We would appreciate receiving this form whether of not you harvested an animal(s).

Figure 4: Example of a fully completed hunter observation report form.

This is the nineteenth consecutive year that a summary of the data collected by ENR on non-resident hunters in the Mackenzie Mountains has been made. In the text of this document, data for 1995 are found in Veitch and Popko (1996), for 1996 in Veitch and Popko (1997), for 1997 in Veitch and Simmons (1998), for 1998 in Veitch et al. 2000b, for 1999 and 2000 in Veitch and Simmons (2000, 2002, respectively), for 2001 by Veitch and Simmons (unpublished data), for 2002-2012 in Larter and Allaire (2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013 respectively). Additionally, Latour and MacLean (1994) summarized data for 1979 - 1990. This report compiles the harvest data collected during the 2013 hunting season and compares it with available data collected since 1995, and earlier when available.

Nahanni National Park Reserve Expansion

Nahanni National Park Reserve (NNPR), encompassing an area of 4,766 km^2 in the southern Mackenzie Mountains, was originalliy established in 1972, after Prime Minister Pierre Elloit Trudeau canoed down the Nahanni River. The Park was in "reserve" status pending settlement of outstanding Aboriginal land claims in the region, which remain ongoing. On 9 June, 2009, the Canadian government, with Dehcho First Nations, announced legislation increasing the area of NNPR to *ca.* 30,000 km^2 (11,583 mi^2). This newly enlarged boundary includes 91% of the greater Nahanni ecosystem and most of the South Nahanni River watershed in the Dehcho region (www.pc.gc.ca).

The enlarged boundary also overlaps three of the eight outfitting zones which were established in the Mackenzie Mountains in 1965: Ram Head Outfitters (S/OT/03), South Nahanni Outfitters (D/OT/01) and Nahanni Butte Outfitters (D/OT/02). Of the total area of their outfitting zones, 4.7% of the Ramhead zone, 27.2% of the South Nahanni zone and 79.4% of the Nahanni Butte zone fall within the newly expanded boundary of the NNPR (Table 1).

Table 1: The area (km²) and % of the outfitting zone that lie within the 2009 expanded boundary of NNPR.

Outfitter	Area of Outfitting Zone	Area of Outfitting Zone within New NNPR	% of Zone within New NNPR
Ram Head Outfitters	19,734.82 km²	921.27 km²	4.7 %
South Nahanni Outfitters	25,024.16 km²	6,811.10 km²	27.2 %
Nahanni Butte Outfitters	21,962.30 km²	17,450.66 km²	79.4 %

Parks Canada is currently negotiating with the operators of these outfitting zones in regards to third party interests and land transfer. A tentative ten year time line from the date of the announced expanded boundary has been proposed. Until negotiations have been completed, and the GNWT has been advised of such, it remains business as usual for these outfitters; ENR will continue to issue licences, tags, and export permits for harvesting by these three outfitters in their zones.

The Prairie Creek mine, established in 1966, now falls completely within the newly expanded boundary of NNPR. However, the mine and an area of *ca.* 300 km^2 surrounding the site were specifically excluded from NNPR so that the mine owned by Canadian Zinc was assured of its third party rights to operate and access the mine site. A new bill amending the National Parks Act solely for NNPR was required to assure these third party rights (www.canadianzinc.com).

Prevalence of *Trichinella* spp. in Mackenzie Mountain Wildlife

Larter et al. (2011) reported a high prevalence of the parasite *Trichinella* spp. in wolves (52%) and grizzly bears (73%) in the Dehcho. As part of a wildlife disease monitoring program, ENR requested samples of the tongue from harvested animals during 2011-2013 to see if these parasites were also prevalent in prey populations and to document occurrence specifically in the

Mackenzie Mountains. We report results of *Trichinella* spp. testing for Dall's sheep, northern mountain caribou, moose, mountain goat, and wolves.

METHODS

General Background

Prior to the start of the 2013 hunting season, each outfitter in the Mackenzie Mountains received sufficient copies of the outfitter return and hunter observation forms for all their clients for the year. The *Wildlife Business Regulations* requires outfitter return forms to be returned by the tenth day of the month following the month of the hunt – e.g. for a hunter that was in the field in July, a form must be submitted by the 10th of August. Those forms were submitted to the senior biologist in the Dehcho or Sahtu region, whether or not a client actually hunted and whether or not harvest occurred. In co-operation with ENR Renewable Resource Officers and the outfitters, persistent attempts were made to obtain outfitter return forms for every non-resident that held a big game hunting licence through a Mackenzie Mountain outfitter in 2013.

Data from both the outfitter return forms and hunter observation forms were entered into Microsoft Excel (Microsoft Corporation 2010) spreadsheets. Data were cross-checked with the records of sequentially numbered, unique identifier plugs inserted in the horns of legally harvested rams found in the Licence Information System-IntraNet (LISIN) data management system maintained by ENR offices across the NWT, and also with GNWT wildlife export permit forms, to ensure that all data were verified and the spreadsheets contained all appropriate available data required for analyses.

We distributed new hunter observation forms in 2013 for consistency and recorded all observations directly from these hunter observation forms. If we did not receive a hunter observation form, but wildlife observation data were recorded on the outfitter return form, we used these wildlife observation data. If observation information differed between the hunter observation form and the outfitter return form for the same client, we used the data from the hunter observation

form. Occasionally we received identical observation data from forms of different hunters. These hunters had the same guides and lengths of hunts, and obviously had hunted together. We recorded forms with data that had been provided, but for the wildlife observation analyses only one set of observations was used.

All descriptive statistical analyses were performed using Microsoft Excel. We present means ± standard deviation (SD). Some additional statistical analyses were performed using Minitab 7.2 software (Minitab Inc. 1989).

Prevalence of *Trichinella* spp. in Mackenzie Mountain Wildlife

When the opportunity arose outfitters/guides collected tongue samples, keeping them chilled or frozen until they could be transferred to the regional ENR office. Samples were frozen and forwarded to the Veterinary Pathology Lab at the Western College of Veterinary Medicine, Saskatoon, for analysis.

Frozen tongue samples were thawed to room temperature and trimmed to remove fat and connective tissue. The digestion assay for the detection of *Trichinella* spp. larvae in muscle tissue followed Forbes and Gajadhar (1999) and Forbes et al. (2008). Weights of tested tongue muscle ranged from 5-10 g for Dall's sheep, 6.3-15 g for northern mountain caribou, 10-15 g for moose, 5 g for mountain goat, and 5-25 g for wolves. Because sample size varied, results were converted to larva/g of muscle tested. We report results for Dall's sheep, northern mountain caribou, moose, mountain goat and wolves.

RESULTS AND DISCUSSION

Hunters

Big game hunting licences for the Mackenzie Mountains were bought by 401 non-resident hunters in 2013 (Table 2). This is up from the annual average of 368 licences sold between 1991-2013 (range 321-407), but similar to licence sales over the past nine years (Figure 5, Appendix F). Of those 401 hunters, 368 came to the NWT and spent some time hunting. The remaining 33 either cancelled their hunts, decided not to hunt for themselves but participated with other hunters they knew, or decided not to hunt due to unforeseen complications after arriving in the NWT. Nineteen of these 33 were guides. Guides often purchase licences every year but rarely have the opportunity to hunt themselves.

In 2013, licence sales to non-resident Canadians (n=98) and residents of countries other than the United States (n=67) represented 24% and 17%, respectively, of the number of licences sold (Table 2, Figure 6). The percentage of hunters from the United States has decreased since 2005. Conversely, the percentage of hunters from elsewhere in the Americas and Europe has increased. The change in ownership of South Nahanni Outfitters (D/OT/01) directly resulted in an increased number of European and South American clients. We presume the continued strength of the Canadian dollar is a factor in this change. Guided hunts are marketed in American dollars. A weaker American dollar against foreign currencies makes hunts more attractive to foreign clients, and outfitters realize the need to diversify their clientelle base (Jim Lancaster, personal communication).

Table 2: Province, state and/or country of origin of the 401 non-residents who purchased licences for hunting in the Mackenzie Mountains, 2013.

Canada		United States		Europe		Other	
Yukon	1	Eastern States[1]	99	Germany	22	Mexico	5
British Columbia	35			Spain	4	Russia	1
Alberta	52	Western States[2]	137	Sweden	2	Lithuania	1
Saskatchewan	2			Austria	6	Australia	6
Ontario/ Quebec	6			France	5	Philippines	1
Atlantic Provinces	2			Norway	5		
				Belgium	7		
				Czech Republic	2		
Total	**98**		**236**		**53**		**14**

[1]AL, AR, CT, DE, FL, GA, IL, IN, IA, KY, LA, ME, MD, MA, MI, MN, MS, MO, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV, WI
[2]AK, AZ, CA, CO, HI, ID, KS, MT, NE, NV, NM, ND, OK, OR, SD, TX, UT, WA, WY

Table 3: Percent of Mackenzie Mountain outfitter and non-resident hunter forms submitted, 1995-2013.

Form Type	2013	2012	2011	2010	2009	2008	2007	2006	2005
Outfitter Return (mandatory)	98	99	99	98	99	99	98	99	100
Hunter Observation (voluntary)	56[1]	60	62	60	62	71	65	64	65

Form Type	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
Outfitter Return (mandatory)	99	98	95	92	96	96	97	98	100	98
Hunter Observation (voluntary)	74	60	59	57	53	51	60	50	71	80

[1]5% of forms were lost after being completed but prior to submission.

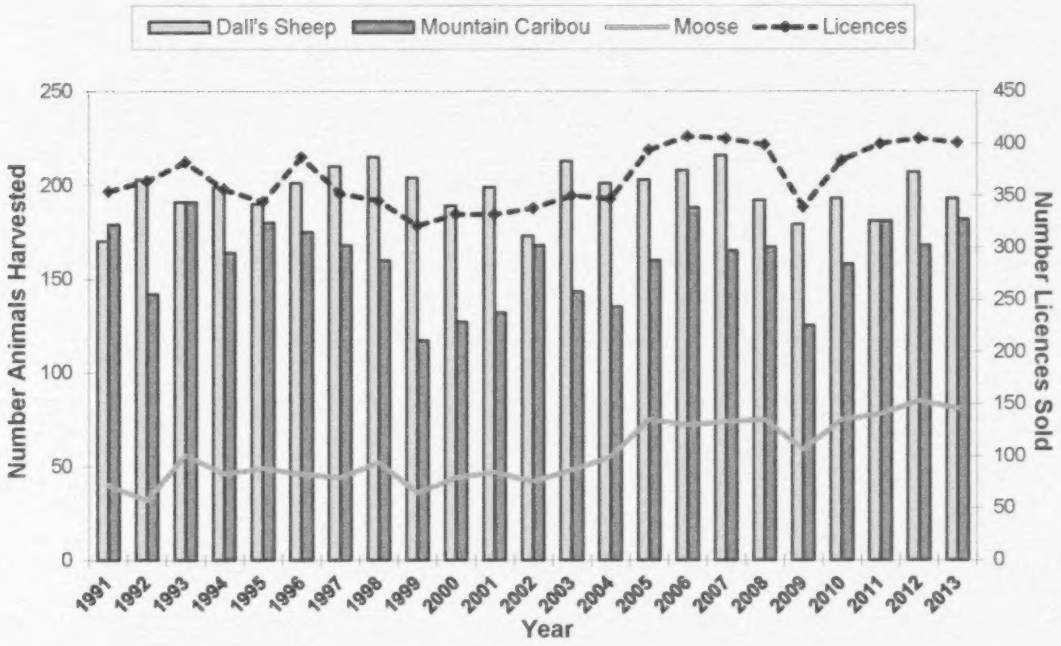


Figure 5: The number of Dall's sheep, mountain caribou, and moose harvested in the Mackenzie Mountains by non-resident hunters, and the number of non-resident licences sold during 1991-2013.

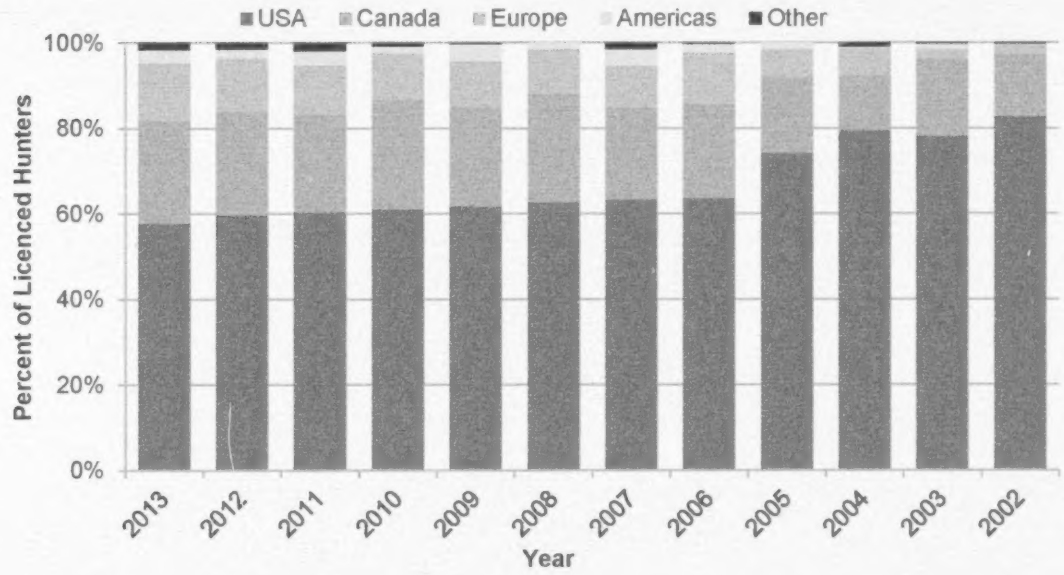


Figure 6: The geographical areas of origin of hunters purchasing licences (in %) to hunt in the Mackenzie Mountains from 2002-2013.

Normally, guided hunting in the Mackenzie Mountains occurs from July to October, however successful winter hunting of wolves occurred for the fifth consecutive year in zone S/OT/01. Four wolves were harvested in the spring of 2014.

We received all but nine mandatory outfitter return forms for the 401 people that purchased non-resident licences. Unfortunately, 16 completed voluntary hunter observation report forms were lost and we received only 212 (56%) of the possible 376 froms from hunters in 2013 (Table 3). We still struggle to get much more than a 60% return on these forms, which is disappointing since there was a consensus by outfitters at the 2003 annual general meeting of the AMMO to increase the return of voluntary hunter observation forms. Although most outfitters endeavour to have clients complete and submit these forms, we received only 61% of the 69 forms from S/OT/02, 48% of the 23 forms from S/OT/04, and 15% of the 47 forms from S/OT/03. The limited returns from outfitting zones with fairly large clientele is of concern because in order to generalize observations over the entire Mackenzie Mountains, representative observations are required from all outfitting zones; two of these outfitter zones with poor return of forms encompass the greatest range in latitude in the Mackenzie Mountains (Figure 1). See Figure 4 as an example of a fully completed hunter observation form.

It is obvious that non-resident hunters immensely enjoy their hunting experience in the Mackenzie Mountains (Table 4). In 2013, 97% of respondents rated their experience as either excellent (86%) or very good (11%). Not only do voluntary client comments make specific mention of the high quality of hunts (n=77), and the abundance/quality of animals (n=39; Appendices C, D), many comments make reference to (1) the professional and world class experience with their chosen guides, (2) the abundance of a wide variety of game species and predators, (3) the apparent health and condition of the game animals, (4) the pristine and scenic

environment of the Mackenzie Mountains, and (5) compliments on the management and stewardship of the land.

Table 4: Satisfaction ratings for non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1996-2013.

Rating	2013	2012	2011	2010	2009	2008	2007	2006	2005
Number of Hunters Reporting	207	212	210	193	191	239	239	230	256
Excellent (%)	86	93	90	88	86	85	81	80	90
Very Good (%)	11	5	6	10	12	10	12	16	7
Good (%)	2	2	4	1	2	4	5	3	2
Fair (%)	1	0	0	1	0	1	2	1	1
Poor (%)	0	0	0	0	0	0	0	0	0
Rating	**2004**	**2003**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**
Number of Hunters Reporting	229	191	193	191	158	157	202	144	224
Excellent (%)	84	82	82	75	76	73	80	78	77
Very Good (%)	10	15	15	16	17	20	17	17	17
Good (%)	5	3	3	6	6	5	2	3	2
Fair (%)	0	0	0	1	0	1	1	1	3
Poor (%)	1	0	0	1	1	2	0	1	1

Comments about grizzly bears have been common since the start of the voluntary hunter observation forms in 1995; their abundance, problems created around camps and kills, and the lack of, and need for, a grizzly hunting season being consistent themes. This year was no different (Appendices C, D). In 2000 we started getting comments about high wolf numbers. This is the first year since 2000 we did not receive comments about high wolf numbers. Comments about the expansion of NNPR questioned the need for such a large expansion, especially in an area that had been so respectfully managed on a sustainable basis, as well as lost

hunting opportunities. There was a suggestion about making a provision for hunting to continue in the expanded area given that GHL holders can hunt in the area.

It was the first time hunting in the Mackenzie Mountains for 158 of 207 (76%) respondents (including non-hunting guides). The 47 repeat hunters had hunted from 2-25 times previously. Of 210 respondents (including non-hunting guides) 90% indicated they would like to return to the Mackenzie Mountains to hunt in the future.

Prior to the 2009 hunting season ENR worked with AMMO to devise a better reporting system for wild game meat use and distribution. What resulted was a supplementary summary meat record form that ENR provided to each outfitter. The new form could be used by itself or with the AMMO meat forms which were voluntarily submitted to ENR. Unfortunately, in the past, AMMO meat forms from outfitters in the Sahtu did not always get turned in and/or forwarded to the Dehcho ENR office. Some outfitters kept the meat forms for their own records in order to have them available for inspection (Kelly Hougen, personal communication). Both forms record the amount of meat (Dall's sheep, northern mountain caribou, moose, and mountain goat) taken from harvested animals and how the meat was used and/or distributed. This year, in addition to the 106 AMMO meat forms submitted, we received summary forms from all eight outfitters. This is the third consecutive year we received records of meat distribution from all eight outfitters. ENR will continue to provide supplementry meat forms to all outfitters.

The distribution of wild game meat by outfitters is an important and greatly appreciated local benefit but can often be a topic of heated local debate. Meat is used in outfitter camps by guides and clients, is taken out with clients, and is provided to local communities. We believe that the information from summary meat record forms provides a better overall picture of the amount of wild game meat being distributed by the outfitters. Generally the majority of meat

from harvested Dall's sheep and mountain goats is used in outfitter camps. Nevertheless, at least 1,504 kg (3,308 lbs.) from 180 harvested Dall's sheep and 184 kg (405 lbs.) from 11 harvested mountain goats was distributed locally. Northern mountain caribou and moose meat is also used in outfitter camps, but harvested mountain caribou and moose make up a large portion of the wild game meat that is distributed locally: at least 9,003 kg (19,806 lbs.) from 177 northern mountain caribou and at least 12,205 kg (26,850 lbs.) from 78 moose. If we use a relatively conservative $25/kg as the replacement cost for meat from local northern retailers, then some $572,375 of meat was distributed locally in 2013.

Dall's Sheep (*Ovis dalli*)

Dall's sheep is one of the most desired species sought by non-resident hunters in the Mackenzie Mountains. Tags to hunt Dall's sheep were purchased by 264 (66%) non-resident hunters in 2013. This is similar to the average number of tags purchased in the past 19 years (Table 7). At least 73% of sheep tag holders (including eight resident hunters) pursued Dall's sheep and harvested 193 rams, slightly less than the average 197 sheep harvested in the Mackenzie Mountains (1991-2012) (Figure 5, Appendix F). The mean (±SD) length of a sheep hunt was 4.0±3.0 days, similar to hunt lengths from 1997-2012 (Table 5), but less than the 5.3 day average from 1979-1990 (Latour and MacLean 1994). Outfitted hunts in the Mackenzie Mountains are generally booked for ten days; when hunters fill their sheep tag, any remaining time is typically spent in pursuit of other big game species for which tags are held, or in hunting small game. The number of hunters taking multispecies hunts has increased in recent years (Jim Lancaster, personal communication and Werner Aschbacher, personal communication).

Harvest by non-residents comprises at least 90% of the total annual harvest of Dall's sheep in the Mackenzie Mountains and takes only 0.9-1.6% of the estimated 14,000-26,000

Dall's sheep in the Mackenzie Mountains (Veitch et al. 2000a). Therefore, the current non-resident harvest level appears well within sustainable limits, provided that hunting pressure is geographically distributed across each of the zones. In the Yukon Territory - where harvest is managed by a full curl rule – Dall's sheep managers have set the sustainable harvest at 4% of the non-lamb population (Yukon Renewable Resources 1996). In those areas of the Yukon where the management objective is to increase population size, harvest is limited to 2% of the total population.

There has been remarkable consistency in the mean outside contour length of the right horns from rams harvested by non-residents for the past 41 years (1972-2013), mean 89.0±1.6cm (SD) (Appendix E, Table 6), which is surprising given the increase in average age of harvested sheep during that same period. We expected to see more broomed or broken horn tips on older animals, since horn breakage generally occurs as a result of fights between rival males (Geist 1993).

This year we aged all of the 193 harvested rams; 120 (62%) were ≥10-years-old. The mean age (±SD) of harvested rams was 10.5±1.5 years (range 7.5-15.5 years, Figure 7). This is the fourth highest average age of harvested rams recorded in the Mackenzie Mountains since records have been kept (1967) and the 26th consecutive year where the reported mean age of harvested rams was 9.5 years or older (Appendix E). Only 28% of left and 25% of right horns from plugged trophies were broomed. This is considerably lower than the 31% (left) and 32% (right) brooming average over the past 17 years.

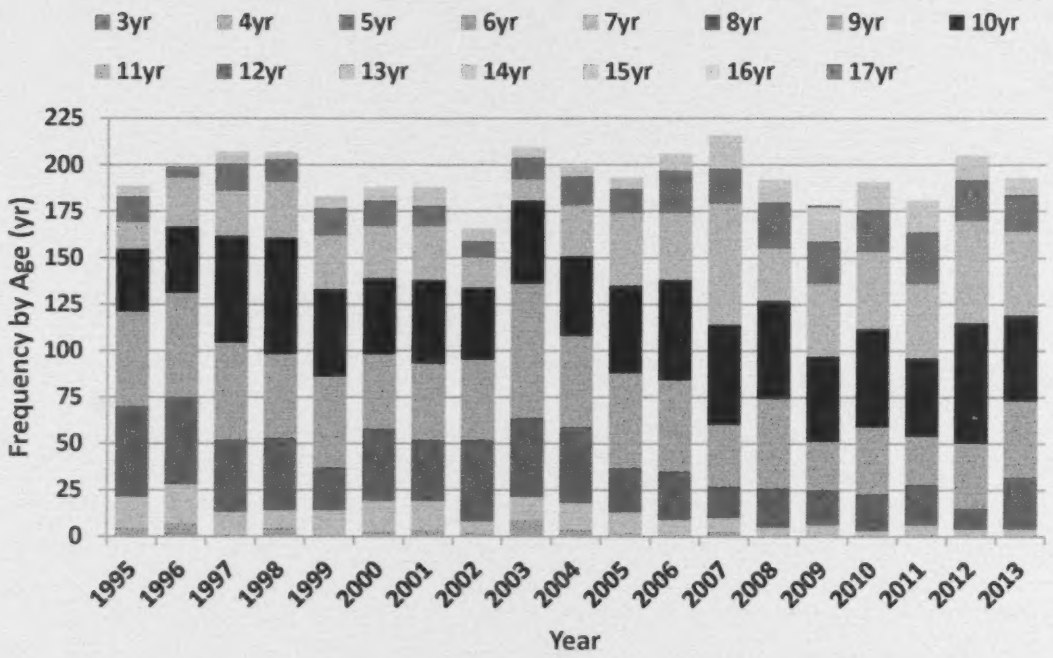


Figure 7: Age-structure of Dall's sheep ram harvest by non-resident and resident hunters in the Mackenzie Mountains, 1995-2013, based upon counting horn annuli.

The continued high age of harvested trophy sheep may be a result of harvest being spread out in time and space within hunting zones. Exclusivity of non-resident big game harvesting within each zone provides the opportunity for outfitters to harvest in different parts of their zone on a rotational basis and forgo hunting in some areas for two or three seasons. In recent years some outfitters have used helicopters to gain access into areas not accessible by horseback. These areas that have not been previously hunted, spread out the harvest in space and likely contribute to the continued high average age of harvested rams.

Table 5: Mean length, SD, and range (in days) of Dall's sheep hunts where at least one day was spent hunting from 1997-2013.

	2013	2012	2011	2010	2009	2008	2007	2006
Number of Reports	193	207	173	179	179	192	216	214
Mean Hunt Length	4.0	4.0	4.0	4.0	3.9	3.7	4.1	4.1
SD	3.0	3.0	3.0	3.0	2.6	2.6	2.6	2.7
Range	1-13	1-14	1-11	1-13	1-10	1-14	1-13	1-12
	2005	**2004**	**2003**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**
Number of Reports	190	167	189	174	176	198	201	224	216
Mean Hunt Length	4.1	4.0	3.8	4.7	4.8	4.6	4.7	4.4	4.3
SD	2.6	2.9	2.9	2.7	3.0	2.7	3.1	2.8	2.6
Range	1-14	1-17	1-12	1-15	1-15	1-15	1-16	1-15	1-12

We calculated an estimated 51.8 lambs per 100 ewes based upon hunter classifications of sheep observed during their hunts in 2013 (Table 8), slightly lower than the average ratio of 54 lambs:100 ewes reported since 1995 (Appendix G). Ground-based surveys were conducted in July in two areas of the northern Sahtu region of the Mackenzie Mountains on an annual or semi-annual basis from 1997-2011. Average ratios of 65.3 and 57.3 lambs:100 ewes were reported (Veitch et al. unpublished data). For the Richardson Mountains of the northern Yukon and NWT, Nagy and Carey (2013) suggest an August ratio of 43 lambs:100 ewes would have allowed for their observed 10.5% average annual rate of increase from 1986-1991. Subsequent to a decline in this unhunted population from 1997-2003, Nagy et al. (unpublished data) reported 28 lambs per 100 'nursery sheep' in August 2003. Jorgenson (1992) summarized 17 years of lamb:ewe classification data for a population of bighorn sheep in west-central Alberta and found a mean ratio of 43 lambs:100 ewes in September (range 25-54).

Differences in adult sex ratios among populations may result from differences in hunting pressure, differences in survival of males and females from birth to adulthood, or both (Nichols and Bunnell 1999). However, since the ratio of rams to ewes is almost never equal in wild populations of mountain sheep, even where they are unhunted, it is clear that there is a different natural mortality rate for the two sexes. This difference was believed to be a result of injuries and stress accumulated by males during the breeding season (Geist 1971).

Table 6: Measurements of Dall's sheep ram horns from sheep harvested by non-resident hunters in the Mackenzie Mountains, 2013.

	Left Horn Contour Length		Right Horn Contour Length		Left Horn Base Circumference		Right Horn Base Circumference		Tip To Tip Spread	
	cm	in	cm	in	cm	in	cm	in	cm	in
Mean	87.2	34.3	87.5	34.4	32.3	12.7	32.3	12.7	58.3	23.0
Std Dev	8.4	3.3	7.9	3.1	1.8	0.7	1.8	0.7	10.4	4.1
Maximum	104.5	41.1	105.0	41.3	37.5	14.8	38.0	15.0	79.0	31.1
Minimum	62.0	24.4	67.0	26.4	26.0	10.2	27.0	10.6	42.5	16.7

The 92 ram:100 ewe ratio estimated from hunter observations in 2013 is slightly higher than the average 88 ram:100 ewe reported from 1995-2013 (Appendix G). Ground-based surveys were conducted in July in two areas of the northern Sahtu region of the Mackenzie Mountains on an annual or semi-annual basis from 1997-2011. Average ratios of 63.4 and 58.1 rams:100 ewes were reported (Veitch et al. unpublished data).

In the Yukon, mid- to late June annual aerial surveys to count and classify sheep from 1973-1998 reported a mean of 48 rams (range 28 to 74) per 100 'nursery sheep' (Jean Carey, Yukon Dept. of Renewable Resources, unpublished data). For the unhunted Richardson Mountains herd (YK-NWT), Nagy et al. (unpublished data) reported 41 rams per 100 'nursery

sheep' in 2003 following a decline from peak population size in 1997. In Alaska, ram:ewe ratio for two unhunted herds in Denali and Gates of the Arctic National Parks typically averaged 60-67:100 (Nichols and Bunnell 1999). In more heavily hunted Alaskan herds, ram:ewe ratio ranged from 33:100 (heavily hunted) to 87:100 (lightly hunted). The ram:ewe ratios reported for the Mackenzie Mountains since 1995 (Appendix G) suggest that the harvest of rams in the Mackenzie Mountains is sustainable at current levels.

Table 7: Tags for big game species purchased by non-resident hunters with outfitters in the Mackenzie Mountains, 1995-2013.

Species	2013 401 hunters		2012 396 hunters		2011 400 hunters		2010 384 hunters		2009 339 hunters		2008 391 hunters		2007 399 hunters		2006 407 hunters		2005 394 hunters	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Dall's Sheep	264	66	270	68	251	63	253	66	215	63	261	67	266	67	276	68	246	62
Mountain Caribou	296	74	300	76	314	79	295	77	252	74	275	70	272	68	274	67	285	72
Moose	131	33	115	29	121	30	116	30	96	28	109	28	108	27	112	28	101	26
Mountain Goat	58	14	42	11	55	14	45	12	45	13	45	12	50	13	21	5	40	10
Wolf	299	75	292	74	285	71	294	77	252	74	228	58	227	57	201	49	214	51
Wolverine	155	39	153	39	163	41	171	45	133	39	111	28	150	38	108	27	154	39
Black Bear	34	8	16	4	32	8	28	7	22	6	2	1	7	2	3	1	40	10

Species	2004 337 hunters		2003 347 hunters		2002 329 hunters		2001 339 hunters		2000 332 hunters		1999 321 hunters		1998 345 hunters		1997 352 hunters		1996 387 hunters		1995 343 hunters	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Dall's Sheep	229	68	257	74	218	66	220	65	231	70	227	71	246	71	252	72	252	65	218	64
Mountain Caribou	243	72	247	71	229	69	201	59	206	62	181	56	223	65	260	74	274	71	233	68
Moose	84	25	85	24	68	21	65	19	69	21	63	20	69	20	73	21	74	18	70	20
Mountain Goat	24	7	18	5	18	5	12	4	12	4	6	2	23	7	30	8	14	4	16	5
Wolf	166	49	207	60	159	48	137	40	155	47	89	28	165	48	209	59	193	50	72	21
Wolverine	89	26	141	40	97	29	83	25	85	26	65	20	99	29	135	38	114	30	35	10
Black Bear	8	2	9	3	3	1	0	0	6	2	2	<1	2	<1	8	2	0	0	0	0

Table 8: Observations of Dall's sheep reported by non-resident hunters in the Mackenzie Mountains, 2013.

	Number of Hunters Reporting	Number Observed	Mean Number Observed/hunter	% of Sheep Classified
Rams	173	2,525	15.0	37.8
Ewes[1]	155	2,736	18.0	41.0
Lambs	149	1,417	10.0	21.2

[1] includes females >1-yr-old, yearlings, and younger rams. Also called nursery sheep.

Fewer rams were classified by curl in 2013 than in most previous years (Table 9). This may be a reflection of a low return in observation forms this year. This year, hunters observed fewer legal (>¾ curl) rams (n=1,006) than rams with <¾ curl (n=1230). The mean number of legal rams observed per hunt was 6.0 (Table 9). In most years hunters have observed fewer legal rams than rams <¾ curl (Table 9).

Samples of tongue were available from 20 animals. An average of 8.7 g (range 5.0-10.0 g) muscle per animal was tested for the presence of *Trichinella* spp. All 20 samples tested were negative.

Table 9: Classification of Dall's sheep rams observed by non-resident hunters in the Mackenzie Mountains, 1995-2013.

Ram Class	2013		2012		2011		2010		2009		2008		2007		2006		2005	
	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl
Number of hunters reporting	156	149	140	124	149	133	158	142	139	132	184	174	150	168	180	171	186	182
Number of rams classified	1006	1230	1117	987	1234	1168	1314	1620	1040	1093	1520	1698	1902	2266	1769	2019	1787	1899
% of rams classified	45.0	55.0	53.0	47.0	51.4	48.6	48.8	55.2	48.8	51.2	47.2	52.8	45.6	54.4	46.7	53.3	48.5	51.5
Mean number of rams observed/hunt	6.0	8.0	8.0	8.0	8.0	9.0	8.3	11.4	7.5	8.3	8.3	9.8	11.0	13.5	9.9	12.0	9.6	10.4

Ram Class	2004		2003		2002		2001		2000		1999		1998		1997		1996		1995	
	Horn > ¾ curl	Horn <¾ curl	Horn > ¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl	Horn ≥¾ curl	Horn <¾ curl
Number of hunters reporting	188	183	127	121	148	133	186	174	151	147	144	138	177	177	205	205	172	174	181	180
Number of rams classified	2185	2324	1662	1654	1720	1720	1812	1765	1351	1717	1579	1756	1848	1924	1538	1586	1713	1699	2070	1645
% of rams classified	48.5	51.5	50.1	49.9	50.0	50.0	50.7	49.3	44.0	56.0	47.3	52.7	49.0	51.0	49.2	50.8	50.2	49.8	55.7	44.3
Mean number of rams observed/hunt	11.6	12.7	11.9	11.9	11.6	12.9	9.7	10.1	8.9	11.7	11.0	12.7	10.4	11.3	7.5	7.7	10.0	9.8	11.4	9.1

Northern Mountain Caribou (*Rangifer tarandus caribou*)

In their 2002 assessment, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the boreal population of woodland caribou as Threatened and the Northern Mountain population of woodland caribou as Special Concern. These two populations of woodland caribou were subsequently listed under the federal *Species at Risk Act* (SARA) in 2004 and 2007 respectively. Caribou of the Mackenzie Mountains are part of the northern mountain population of woodland caribou. In order to be more specific and to avoid confusion this report will use "northern mountain caribou" when referring to caribou from the Mackenzie Mountains.

Northern mountain caribou are another of the more desired species sought by non-resident hunters. Tags were purchased by 296 (74%) of non-resident hunters (Table 7); the third highest number of tags purchased since reporting started in 1991 (average 256, range 181-314). At least 61% of tag holders hunted caribou, harvesting 182 males. This is the third highest harvest and higher than the annual average harvest of 160 from 1991-2013 (Figure 5, Appendix F). The mean (±SD) length of a caribou hunt, determined from the 196 reports where hunters spent at least one day hunting, was 3.0±3.0 days (range 1-13 days), comparable to that of previous years (Table 10).

Since 2011 ENR has collected front incisor teeth from caribou harvested by hunters in the southern portion of the Mackenzie Mountains, on a voluntary basis. Teeth are forwarded to Matson's Laboratory for aging. Age is determined by counting the cementum annuli much like the growth rings of a tree. June 1 is used as the birth date for caribou (Matson 1981). We currently have ages from 32 harvested caribou; ages range from 2-11 years (mean 6.5 years, median 6.3 years; Figure 8).

We calculated ratios of 36.3 calves and 42.9 bulls (males) per 100 adult females (cows) based upon hunter classifications of northern mountain caribou observed during their hunts. Bulls comprised 24.0% of all caribou classified (Table 11). Calf:cow ratios were lower than the average of 43:100 (range 35-59:100) calculated since 1995; conversely bull:cow ratios were higher than the average 38:100 (range 21-61:100) calculated since 1995 (Appendix G).

In 2013 we received antler lengths from 131 (72%) successful hunters; more than in previous years. Antler measurement information sometimes goes unreported on outfitter forms. This year, as in other years, there was substantial variation in antler lengths, range 71.0-142.0 cm (28.0-55.9 in.). The maximum left and right antler lengths reported were 140.0 and 142.0 cm respectively (Table 12). The maximum antler length recorded by Boone and Crockett for northern mountain woodland caribou in North America is 158.5 cm (62.4 in.) for a caribou taken from the Mackenzie Mountains in 1978 (Byers and Bettas 1999). Thirteen of the top 50 mountain woodland caribou recorded in the 12th edition of the Boone and Crockett Club record book are from the Mackenzie Mountains; the highest scoring antlers hold 7th place (Boone and Crockett Club, on-line trophy database accessed 2014). Another measuring system for antlered animals is from Safari Club International (SCI), which has a unique all-inclusive record keeping system for measuring trophies, the most used system in the world. Unlike Boone and Crockett this system has no deductions or penalizing for asymmetry and provides points for all tines which is important for caribou (Jim Lancaster, personal communication). Eight of the top 20 mountain woodland caribou recorded in the Safari Club International record book are from the Mackenzie Mountains, with a caribou harvested in 2006 holding second place in scoring (Safari Club International, on-line trophy database accessed 2013).

Since 1991 the percentage of bulls observed by clients in the Mackenzie Mountains has never been greater than 28%. This is a lower percentage than the cumulative 39% average adult bull component reported by Bergerud (1978) in his summary of eight North American caribou populations that were either non-hunted or hunted non-selectively (i.e. both males and females included in the harvest). Veitch et al. (2000c) classified 2,659 of an estimated 5,000 caribou in the central Mackenzie Mountains in August 1999 and reported only 25% of those animals were classified as males. Surveys done on the presumed rutting grounds of the South Nahanni caribou population in 1995, 1996, and 1997 reported 24, 28, and 20% of animals classified as males ≥1-year-old (Gullickson and Manseau 2000) and in 2001 reported 27% bulls (Gunn et al. 2002). A 2007 survey during the rut estimated 33.7 bulls:100 adult cows (R. Farnell and K. Egli, Yukon Territorial Government, unpublished data). A 2008 composition count during the rut in the same general area estimated a slightly higher ratio of 35.5 bulls:100 adult cows (Troy Hegel, personal communication).

Table 10: Mean length, SD, and range (in days) of northern mountain caribou hunts where at least one day was spent hunting from 2000-2013.

	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Number Reports	196	180	187	175	155	190	172	171	191	120	172	181	178	141
Mean Hunt Length	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.3	3.7	4.9	3.8	3.6	4.3	4.0
SD	3.0	3.0	2.0	3.0	3.0	3.0	3.2	3.1	3.8	3.9	2.8	2.7	3.2	2.7
Range	1-13	1-17	1-16	1-14	1-14	1-15	1-16	1-14	1-32	1-34	1-14	1-12	1-15	1-12

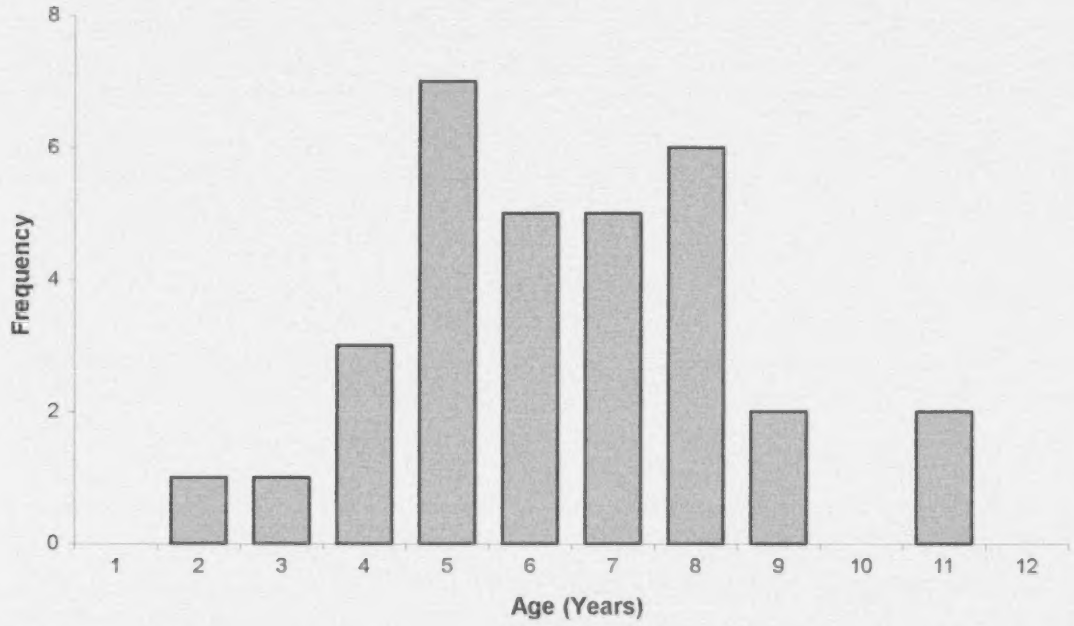


Figure 8: Ages of 32 caribou teeth voluntary provided by southern Mackenzie Mountain outfitters 2011-2013.

Table 11: Observations of northern mountain caribou reported by non-resident hunters in the Mackenzie Mountains, 2013.

Sex/Age Class	Number of Hunters Reporting	Number Observed	Mean Number Observed/hunter	% of Total Classified
Bulls	174	3,567	20.5	23.9
Cows	169	8,319	49.2	55.8
Calves	144	3,021	21.0	20.3

Table 12: Antler measurements of northern mountain caribou bulls harvested by non-resident hunters in the Mackenzie Mountains, 2013. All measurements are in cm (in.).

	Contour Length	
	Left Antler	**Right Antler**
Number Measured	131	131
Mean (cm)	113.0 (44.5 in.)	113.8 (44.8 in.)
SD (cm)	52.1 (20.5 in.)	52.4 (20.6 in.)
Maximum (cm)	140.0 (55.1 in.)	142.0 (55.9 in.)
Minimum (cm)	71.0 (28.0 in.)	78.0 (30.7 in.)

Nagy (2011), using movement data from satellite collared northern mountain caribou in the Sahtu (Olsen 2000, 2001), determined ten activity periods. The breeding period, or rut, was defined as 9-25 October. This period was also the activity period with the greatest daily movement rate (Nagy 2011). Hunter observation data are collected and the 1999 survey was carried out prior to the breeding period (Veitch et al. 2000c). Surveys conducted well before the rut or breeding period may underestimate the male component of the population. The surveys in 2007 and 2008 were conducted in late September and early October, just prior to the defined breeding period, and findings were more comparable to what Bergerud (1978) reported. Based upon hunter observations there is some evidence that the proportion of males differs between

populations and that this difference has been consistent over the past 20 years (Larter 2012a). Further investigation is required to explore demographic attributes of northern mountain caribou in the Mackenzie Mountains.

Northern mountain caribou in the Mackenzie Mountains are estimated to number between 15,000 and 20,000 from at least three separate populations shared between the YK and NWT. Currently, estimated population sizes (excluding calves) are *ca.* 4,200 for the Bonnet Plume, a minimum of 7,300 for the Redstone, and *ca.* 2,700 for the greater Nahanni population (COSEWIC 2014 In press). They are subjected to an annual bull-selective non-resident harvest averaging 160 males per year (1991-2013). The resident harvest of northern mountain caribou in the Mackenzie Mountains also tends to be bull-selective (but not restricted to bulls) and is generally light (*ca.* 30 animals/year); subsistence harvest includes both males and females, with the proportion of each dependent on the time of year that animals are harvested (J. Snortland unpublished data, ENR unpublished data). Subsistence harvesters in the Mackenzie Mountains include residents of both the NWT and YK Territory; harvest is not generally reported.

Studies on the Redstone herd of northern mountain caribou were initiated in March 2002, with ten female caribou being equipped with satellite radio collars as part of a study of caribou in the central and north-central Mackenzie Mountains initiated by the SRRB (Creighton 2006, Olsen 2000, 2001, Olsen et al. 2001). A recent analysis of these location data indicates that some of the collared animals in the range of the Redstone herd are relatively sedentary year round, while others show the more typical seasonal migratory movements (John Nagy, personal communication).

Satellite radio collars were deployed on nine adult female caribou during March 2000 and October 2001 by the Yukon Department of the Environment (Jan Adamczewski, personal

communication). These animals were believed to be part of the greater Nahanni herd. In October 2004, 18 female caribou were equipped with satellite collars along the YK-NWT border. These caribou were also believed to be from the greater Nahanni herd, but three animals were determined to be from the Finlayson herd. This was a co-operative study between YK Territorial Government, Parks Canada (NNPR) and the Wildlife Conservation Society (Weaver 2006). In October 2008, 30 female caribou were equipped with satellite collars along the YK-NWT border. Partners in this project include the YK Territorial Government, Parks Canada Agency, ENR, and the Canadian Parks and Wilderness Society, NWT Chapter (Troy Hegel, personal communication).

Samples of tongue were available from 21 animals. An average of 10.5 g (range 6.3-15.0 g) muscle per animal was tested for the presence of *Trichinella* spp. All samples tested were negative.

Moose (*Alces americanus*)

Tags to hunt moose were purchased by 33% (n=131) of non-resident hunters in 2013; the greatest number since reporting started (Table 7). At least 62% of tag holders hunted moose and harvested 81 bulls; the second highest moose harvest since reporting started in 1991 (range 32-85). Since 2005, the number of moose tags purchased has increased (Table 7, Appendix F). Success rates for moose hunts have remained relatively stable, but the increased number of tag sales in recent years has resulted in an increased overall harvest (Figure 9). The mean (±SD) length of a moose hunt, determined from the 91 reports where hunters spent at least one day hunting, was 4.1±3.1 days (range 1-15 days), similar to reports from previous years (Table 13).

In 2005 there was a noticeable increase in moose harvest relative to pre-2005 levels. The consistently higher post-2004 harvest levels are likely in part related to the change in ownership

of outfitting zone D/OT/01 (Figure 9). This zone is one of the largest, with an abundance of good moose habitat. From 1991-2004 the average harvest was <4 moose/year, with the majority of clients preferring to hunt Dall's sheep. The new owner has a client base which includes many European hunters who are specifically looking for trophy moose for European mounts; also, the new owner hunts in parts of the zone which were previously unhunted. From 2005-2013 the average harvest has been ~20 moose/year from this zone. Moose in the Mackenzie Mountains are considered to be of the Alaska-Yukon race, which is the largest subspecies (www.adfg.alaska.gov/index.cfm?adfg=moose.main). Recently, the Mackenzie Mountains has emerged as one of the top destinations to have success in taking these large moose (Jim Lancaster, personal communication).

Since 2003 ENR has collected front incisor teeth from moose harvested by hunters in the southern portion of the Mackenzie Mountains, on a voluntary basis. Teeth are forwarded to Matson's Laboratory for aging. Age is determined by counting the cementum annuli much like the growth rings of a tree. June 1 is used as the birth date for moose (Matson 1981). We currently have ages from 128 harvested moose; ages range from 3-15 years (mean 7.6 years, median 7.0 years; Figure 10).

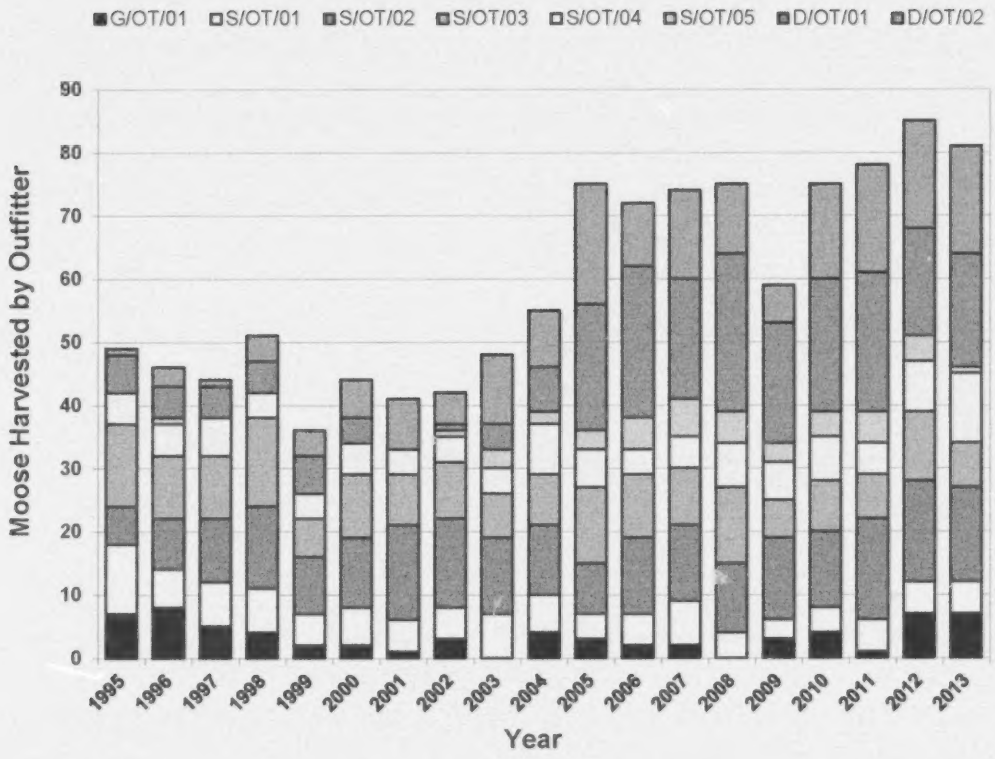


Figure 9: Moose harvested by individual Mackenzie Mountain outfitters from 1995-2013.

The mean (±SD) tip-to-tip spread of measured antlers (n=69) from bull moose harvested in 2013 was 144.9±53.4 cm (57.1±21.0 in.). We have never received more than 69 antler measurements since records have been kept (Table 14). The maximum recorded antler spread was 170.2 cm (67.0 in.), less than the record spread of 196.9 cm (77.5 in.) for a moose taken in the NWT in 1982. Two moose taken from the Mackenzie Mountains are in the top 25 moose recorded in the record book of the Boone and Crockett Club and currently hold 18th and 24th place respectively. A moose harvested in the NWT Mackenzie Mountains in 2008 was accepted in May 2009 and holds 27th place. A moose harvested during the 2010 season ranks second as a Pope and Young World Record moose with a score of 241 5/8.

Table 13: Mean length, SD, and range (in days) of moose hunts where at least one day was spent hunting from 2000-2013.

	2013	**2012**	**2011**	**2010**	**2009**	**2008**	**2007**
Number Reports	91	85	86	86	68	82	80
Mean Hunt Length	4.1	4.2	4.1	4.5	4.2	3.6	4.0
SD	3.1	3.1	2.8	4.0	3.4	2.9	2.5
Range	1-15	1-15	1-14	1-18	1-14	1-16	1-9
	2006	**2005**	**2004**	**2003**	**2002**	**2001**	**2000**
Number Reports	72	85	49	60	46	42	48
Mean Hunt Length	3.6	4.4	4.8	3.9	3.6	3.7	4.4
SD	2.7	3.1	3.3	2.8	2.6	2.9	2.7
Range	1-11	1-14	1-12	1-14	1-12	1-12	1-12

We calculated ratios of 29.5 calves:100 adult females (cows) and 106.1 bulls:100 cows based upon hunter observations of moose during hunts (Table 15, Appendix G). The calves:100 adult females in 2013 is lower than the average 30:100 calf:cow ratio recorded since 1995. This is the first year since 2004 that the ratio has been less than 30:100. Lost hunter observation forms from a zone with relatively abundant moose may have been a factor in the lower ratio reported this year. The calf:cow ratio reported for the fall remains lower than the 40-60:100 that is generally documented during early to mid-winter aerial surveys for moose along the Mackenzie River in the vicinity of the communities of Fort Good Hope (MacLean 1994a), Norman Wells (Veitch et al. 1996) and Tulita (MacLean 1994b) (Appendix G). However, these surveys were conducted after the major fall subsistence harvest and variable female harvest can certainly impact the interpretation of calf:cow ratios. As no research has been done on moose in the

Mackenzie Mountains, we have no explanation for the apparent discrepancy in calf production, survival, or both between the mountains and the river valley. A survey of moose in the Norman Wells study area in January 2001 estimated a calf:cow ratio of 18:100 (ENR Norman Wells unpublished data), and an aerial survey of the Mackenzie River Valley and vicinity in the Dehcho region south from the Blackwater River to Jean Marie River conducted in November 2003 estimated 32:100 (Larter 2009). These studies indicate that low calf:cow ratios may not be restricted to the Mackenzie Mountains and that further studies are required to determine the cause(s). A program was established to document calf:cow ratios annually in November in designated areas of the Mackenzie and Liard River Valleys of the Dehcho through 2010 (Larter 2009). A large-scale aerial survey of the Mackenzie River Valley and vicinity south from the Blackwater River to Jean Marie River, conducted in November 2011, estimated a calf:cow ratio of 54:100 (N. Larter and D. Allaire unpublished data).

The bull:cow ratio of 106.1:100 reported for 2013 is higher than the 104:100 average from 1995-2013, but falls within the reported range of 76-137:100 (Appendix G). Bull:cow ratios from the Mackenzie Mountains continue to be generally higher than the range of 27-105:100 reported in the Yukon (R. Ward cited *in* Schwartz 1997) and 16:100 from heavily harvested populations in Alaska (Schwartz et al. 1992), and average of 46:100 from Norway, range (25-69:100) (Solberg et al. 2002). There has been concern that low bull:cow ratios could influence conception dates, pregnancy rates and newborn sex ratios (Bishop and Rausch 1974, Crête et al. 1981, Solberg et al. 2002) and that management strategies should maintain a high bull:cow ratio (Bubenik 1972).

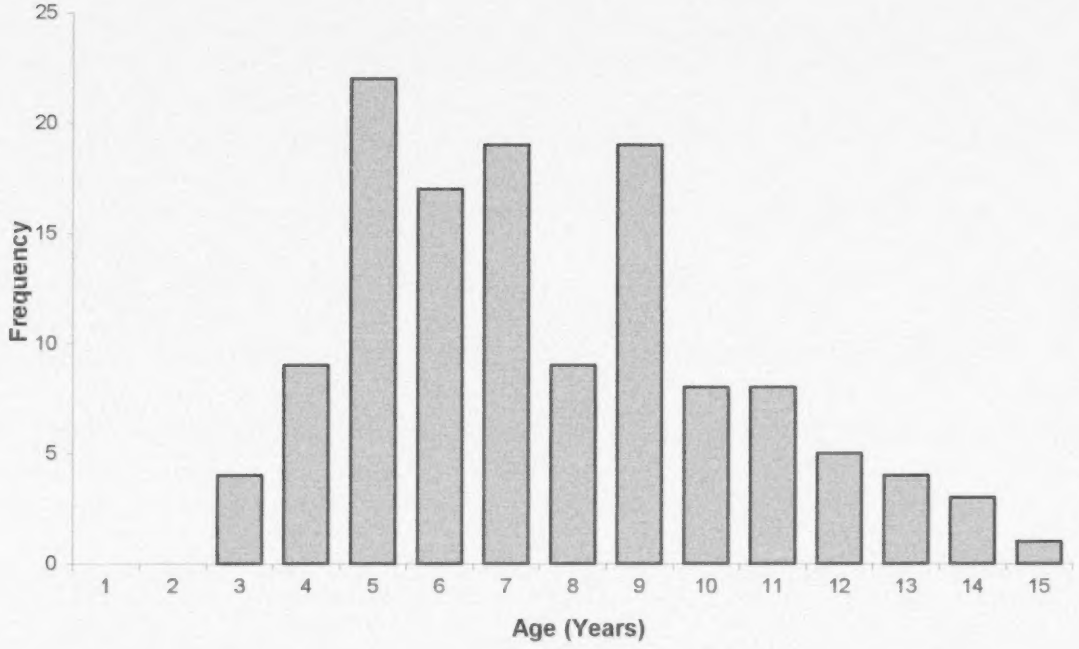


Figure 10: Ages of 128 moose teeth voluntary provided by southern Mackenzie Mountain outfitters 2003-2013.

Studies on tundra moose in Alaska have not found evidence that moose populations with low bull:cow ratios have reduced reproductive rates (Schwartz et al. 1992); populations with a more skewed sex ratio had a relative rate of population increase greater than populations without a skewed sex ratio (Van Ballenberghe 1983). However, a recent study of eight heavily harvested moose populations in Norway indicated a relationship between declining recruitment rate and skewed adult sex ratio (Solberg et al. 2002). Based upon hunter observations since 1995, there is no indication of any decreasing trend in the bull:cow ratio of moose in the Mackenzie Mountains, hence the adult sex ratios are an unlikely factor in the low calf:cow ratios reported. The reported sex ratios may have an inherent bias towards a greater number of bulls if harvesters consistently spend more time searching for moose in areas frequented more by large males than females.

Samples of tongue were available from 24 animals. An average of 11.4 g (range 10.0-15.0 g) muscle per animal was tested for the presence of *Trichinella* spp. All samples tested were negative.

Table 14: The yearly mean and range of measured bull moose tip-to-tip antler spread in cm (in.).

	2013	2012	2011	2010	2009	2008	2007
Measured (n)	69	67	69	65	53	63	62
Mean Spread	144.9 (57.1)	142.9 (56.3)	144.0 (56.7)	143.5 (56.5)	143.5 (56.5)	145.5 (57.3)	141.1 (55.6)
Range	97-170 (38.3-67.0)	98-161 (38.6-63.4)	113-168 (44.5-66.1)	106-174 (41.7-68.5)	92-175 (36.2-68.9)	101-174 (39.8-68.5)	102-179 (40.2-70.5)

	2006	2005	2004	2003	2002	2001	2000	1999
Measured (n)	56	53	38	34	32	32	34	26
Mean Spread	141.3 (55.6)	144.9 (57.0)	150.3 (59.2)	150.0 (59.1)	149.3 (58.8)	144.3 (56.8)	147.0 (57.9)	144.2 (56.8)
Range	107-170 (42.1-66.9)	122-165 (48.0-65.0)	127-174 (50.0-68.5)	107-165 (42.1-65.0)	103-178 (40.6-65.0)	113-165 (44.5-65.0)	127-179 (50.0-70.5)	109-166 (42.9-65.4)

Table 15: Observations of moose reported by non-resident hunters in the Mackenzie Mountains, 2013.

Age/Sex Class	Number of Hunters Reporting	Number Observed	Mean Number Observed/Hunter	% of Total Classified
Bulls	96	385	4.0	45.0
Cows	88	363	4.1	42.5
Calves	53	107	2.0	12.5

Mountain Goat (*Oreamnos americanus*)

Sales of mountain goat tags show more annual fluctuation than any other ungulate species harvested by non-resident hunters in the Mackenzie Mountains, range 6-58 during 1995-2013 (Table 7) with a mean annual harvest of nine goats (range 1-21) over the same time (Appendix F). This year, mountain goat tags were purchased by 58 (14%) of non-resident

hunters; 11 goats (ten males, one female) were harvested. The 2013 harvest is the fewest in the past eight years (Appendix F). The mean (±SD) length of a goat hunt, determined from the 13 reports where hunters spent at least one day hunting, was 2.3±1.3 days (range 1-5 days), similar to that reported in previous years (Table 16).

Mountain goats are known to inhabit five of the eight outfitting zones in the Mackenzie Mountains, occurring almost exclusively below 63°00'N (Veitch et al. 2002). They are most numerous in high relief terrain along the YK-NWT border between 61°00' and 62°00'N. However, since 1995 we have received hunter observations or harvest reports of goats from only four of those outfitter zones - D/OT/01, D/OT/02, S/OT/03, and S/OT/04 (Figure 1). In 2013, observations came from two zones, D/OT/01 (n=49), and D/OT/02 (n=95); harvest occurred in D/OT/01, D/OT/02 and S/OT/03. We estimated 69.6 goat kids and 75.0 billies per 100 nannies based upon hunter observations. Both ratios were higher than the averages from 2002-2013 of 62.9 kids and 65.9 billies per 100 nannies, respectively (Appendix H).

Table 16: Mean length, SD, and range (in days) of goat hunts where at least one day was spent hunting from 2000-2013.

	2013	**2012**	**2011**	**2010**	**2009**	**2008**	**2007**
Number Reports	13	17	20	13	22	21	27
Mean Hunt Length	2.3	2.8	2.3	3.2	2.5	3.0	2.7
SD	1.3	1.7	1.2	1.9	2.0	1.8	1.7
Range	1-5	1-7	1-5	1-7	1-8	1-8	1-6
	2006	**2005**	**2004**	**2003**	**2002**	**2001**	**2000**
Number Reports	12	18	8	6	4	2	1
Mean Hunt Length	2.8	3.8	3.9	3.0	2.8	1.5	3.0
SD	1.5	2.8	1.6	2.6	1.9	0.7	n/a
Range	2-6	1-14	2-6	1-8	1-5	1-2	3

In 2005, we began estimating the age of harvested goats based upon counting horn annuli, and try to age as many harvested goats as possible. The average age from 126 goats (113 billies and 13 nannies) is 7.9 years (range 2.5-15.5). Seventy-one goats were <8 years old with 55 >8 years old and 31 >10 years old (Figure 11). Of the ten male goats aged in 2013, one was aged >10 years. The longest horns from a mountain goat taken in 2013 were 25.0 cm (left) and 24.5 cm (right). No mountain goats from the NWT are listed in the 11th edition of the Boone and Crockett Club record book (Byers and Bettas 1999). Based upon age and horn length data over the past eight years there may be a somewhat linear relationship between age and horn length from 5.5-11.5 years, but for ages outside of that range there is almost no relationship, implying that large horned animals are found over a wide range in animal ages (Figure 12).

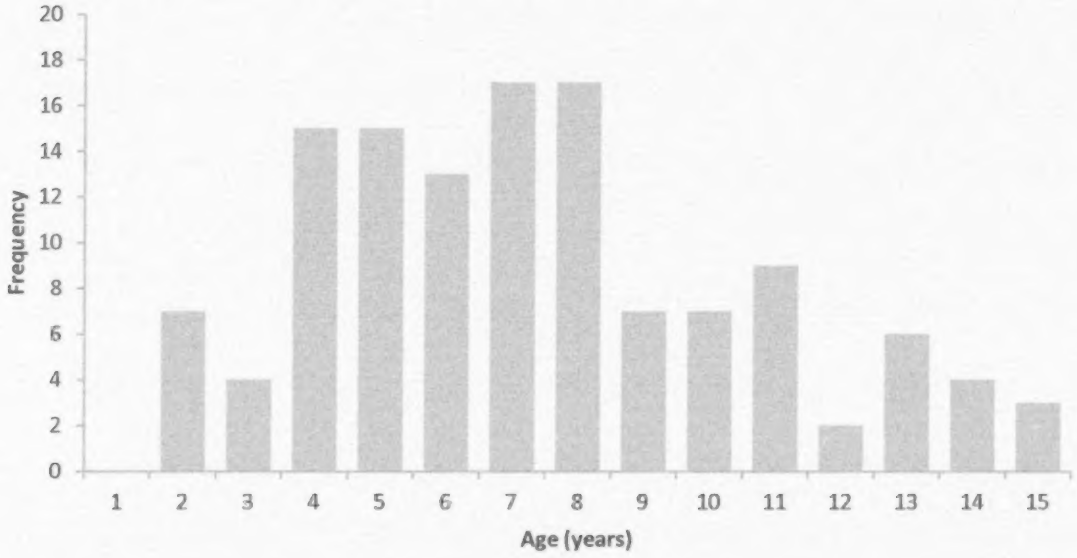


Figure 11: Ages of 126 mountain goats harvested in the southern Mackenzie Mountain based upon counting horn annuli 2005-2013.

There is some evidence that goat numbers and distribution have been increasing in both zones D/OT/01 and D/OT/02 in the southern Mackenzie Mountains (Larter 2004, 2012b; Jim and Clay Lancaster and Werner Aschbacher personal communication). The total number of

goats observed has been increasing in recent years and billies have been observed in places they had not been seen previously in these zones (Clay Lancaster and Werner Aschbacher personal communication; Appendix H).

In a 2.5 hr rotary-winged survey of zone D/OT/02 on 11 September 2006, 88 goats were observed (38 billies, 27 nannies, 19 goat kids, and four yearlings), producing estimates of 140.8 billies and 70.4 goat kids per 100 nannies (N. Larter unpublished data). This survey was conducted in an area that could not be surveyed during a 2004 aerial survey and provided similar numbers of goats and ratio estimates as the 110.7 billies and 71.4 kids per 100 nannies from that 2004 survey (Larter 2004). A rotary-wing survey was conducted 22-24 August 2011 in the Ragged Range area of zone D/OT/01. 278 goats were observed (124 billies, 80 nannies, 50 goat kids, six yearlings; 18 goats were unclassified), producing estimates of 155.0 billies and 62.5 goat kids per 100 nannies (Larter 2012b). These survey results generally support the contention of increasing goat numbers and distribution but we acknowledge there was seven years between surveys. ENR will continue to work with outfitters in zones D/OT/01 and D/OT/02 to better assess the current status of mountain goats in the Mackenzie Mountains.

The increased harvest of mountain goats since 2004 (Appendix F) may be related to changes in accessibility to the more remote and rugged parts of the various outfitter ranges where goats are resident. The use of rotary aircraft in recent years has permitted outfitters to get into some areas of their zones where they have never been before, areas where goats have been found. This increased accessibility to areas of untouched goat range has likely had some effect on the increased success in goat harvest.

Samples of tongue were available from nine animals. A 5 g sample of muscle for each animal was tested for the presence of *Trichinella* spp. All samples tested were negative.

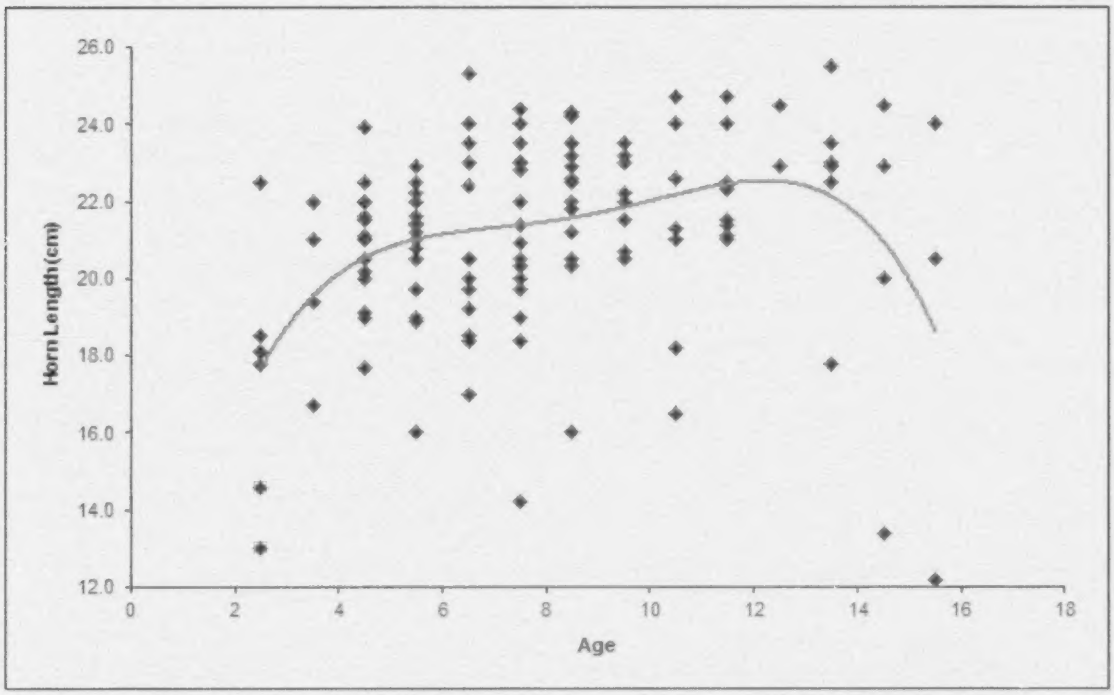


Figure 12: The relationship between the horn length (cm) and age (based upon horn annuli) of 126 mountain goats harvested in the Mackenzie Mountains 2005-2013. Line of best fit is a 4th order polynomial.

Wolf (*Canis lupus*)

Wolf tags were purchased by 75% (n=299) of non-resident hunters in 2013 (Table 7). This is the greatest number of tags and the second highest proportion of hunters purchasing tags in any year since reporting began in 1995 (Table 17). At least 19% (n=57) of tag holders actively hunted wolves. A total of 16 wolves were harvested (two males, four females and ten of unreported sex) (Appendix F). An average of 15 wolves/year have been harvested since reporting started in 1991. Hunters reported spending 1-10 days actively hunting wolves (mean ±SD of 3.7±2.5 days). For the fifth year wolves were hunted during the winter season in zone S/OT/01; four wolves (one male and three females) were harvested in April 2014.

The number of wolves observed in 2013 (n=155) falls within the range of observations from previous years of 142-317). There is no relationship between the number of wolves observed/year and annual harvest nor does the number of tags purchased/year explain annual differences in wolf observations (Table 17). The number of hunters reporting since 2001 has been consistently higher than in previous years, which is attributed to a change in how we defined hunter reporting. For data collected after 2001, we assumed that all returned observation forms where there was a blank, a zero, or a dash in the box indicating the number of wolves observed was a report of no wolves being observed. When looking at the forms this seemed like a reasonable assumption. This assumption may well be invalid for previous years' data and would bias the post 2001 values to be higher than the previous years.

Hunters started commenting that they thought wolf numbers were high in 1999. In subsequent years the number of hunters commenting about high wolf numbers increased. This year none of responding hunters indicated that they thought wolf numbers were high.

Samples of tongue were available from 14 animals. An average of 14.8 g (range 5.0-25.0 g) muscle per animal was tested for the presence of *Trichinella* spp. Twelve animals tested positive; prevalence was 86%. The mean intensity of infection was 4.4 larva/g (range 0.32-11.62).

Table 17: Observations of wolves reported by non-resident hunters in the Mackenzie Mountains, the number of wolves harvested and the number of wolf tags purchased, 1995-2013.

	2013[1]	2012[1]	2011[1]	2010[1]	2009[1]	2008[1]	2007[1]	2006[1]	2005[1]
# Hunters Reporting	242	215	218	203	194	244	244	239	254
# Wolves Observed	155	253	184	203	167	260	262	202	245
# Hunters Seeing ≥1	36	45	74	61	65	76	88	84	76
Number Harvested	16	24	21	19	20	17	12	23	19
Number Wolf Tags	299	292	285	294	252	228	227	201	204

	2004[1]	2003[1]	2002[1]	2001	2000	1999	1998	1997	1996	1995
# Hunters Reporting	244	203	197	142	116	103	148	141	76	119
# Wolves Observed	317	200	249	215	228	142	148	200	186	269
# Hunters Seeing ≥1	81	74	69	65	61	40	57	76	26	26
Number Harvested	18	12	11	15	14	11	9	17	11	14
Number Wolf Tags	166	207	159	137	145	89	165	209	194	72

[1]Change in reporting since 2002 may have resulted in the number of hunters reporting for 1995-2001 being artificially low, see text.

Wolverine (*Gulo gulo*)

Wolverine tags were purchased by 39% (n=155) of non-resident hunters in 2013 (Table 7). This is the third highest number of tags and proportion of hunters purchasing tags in any year since the 1995 reporting began (Table 18). At least 23% (n=35) of tag holders actively hunted wolverine; two wolverines were harvested this year. Hunters reported spending from 1-10 days actively hunting wolverine (mean ±SD of 4.2±2.8 days). Wolverine observations were reported from six of the eight outfitter zones this year, most from S/OT/01 and S/OT/02 (Figure. 8). The majority of reported observations (n=15); there was one observation of a group of two. Historically, wolverine observations have been mostly of solitary animals with few family groups being observed. The number of wolverines observed annually from 1995-2013 seems to

have somewhat of a cyclical pattern (Table 18, Figure 13). Wolverine numbers are believed to be declining in some other parts of their range in the NWT (Suzanne Carrière, personal communication); our observations since 1995 in the Mackenzie Mountains do not show a declining trend.

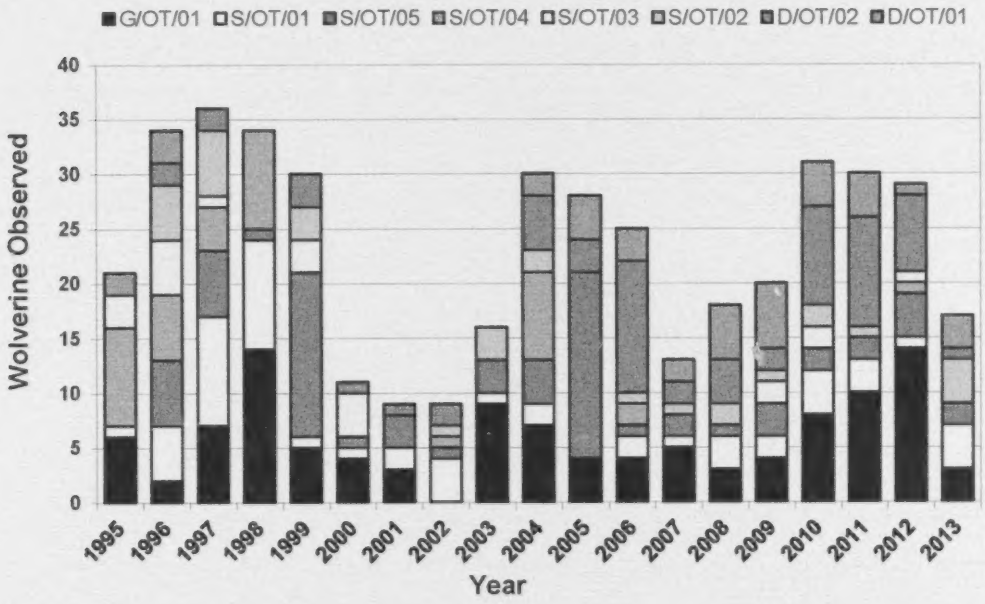


Figure 13: The number of wolverine observed by hunters from 1995-2013 and the outfitter zones where the observations occurred. Data are based upon voluntary hunter observation forms.

There is no relationship between the number of wolverine observed/year and annual harvest nor does the number of tags purchased/year explain annual differences in wolverine observations (Table 18). Wolverines occur throughout the Mackenzie Mountains, but sightings are considered rare. Most wolverine observations are made in hunting zones G/OT/01, S/OT/01, S/OT/05 and D/OT/02.

Table 18: The number of reported observations of wolverine, the number of wolverine harvested, the number of hunters with wolverine tags, the percentage of total hunters with wolverine tags, and the total number of hunting licences purchased for 1995-2013.

Year	2013	2012	2011	2010	2009	2008	2007	2006	2005
Reported Observed	17	29	30	31	20	18	13	25	28
Number Harvested	2	0	2	3	3	1	0	1	1
No. Wolverine Tags	155	153	163	171	133	111	150	108	154
% Wolverine Tags	39	39	41	45	39	28	37	27	39
Total Hunting Licences	401	396	400	384	339	399	405	407	394

Year	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
Reported Observations	30	12	9	9	11	30	34	36	34	21
Number Harvested	0	0	1	2	0	3	0	1	4	1
No. Wolverine Tags	89	141	97	83	78	65	99	135	114	35
% Wolverine Tags	26	40	29	26	23	20	29	38	29	11
Total Hunting Licences	337	347	338	332	332	321	345	352	387	344

Black Bear (*Ursus americanus*)

This year 34 tags were purchased by non-resident hunters for black bears (Table 7); no bears were harvested. Only five black bears have been harvested in the past 23 years. Black bears are relatively rare in the Mackenzie Mountains and when seen are mostly south of 63°00'N. In 2013, 30 black bears (18 adults and 12 cubs) were reported on returned hunter observation forms (Table 19). This falls within the range of 17-56 observed during 2003-2013 (Table 19). The number of cubs reported in 2013 was the most since reporting started in 1995. This year bears were observed in four outfitter zones D/OT/01, D/OT/02, S/OT/01, and S/OT/05, with some being seen north of 64°00'N. As with the other post 2001 carnivore data, we assumed that all returned observation forms where blanks, zeroes, or dashes occurred in the boxes indicating the number of carnivores observed was a report of no carnivores being observed. This assumption is

likely invalid for previous years' data and likely somewhat inflates the post-2001 values relative to 1996-2001 values.

Table 19: Observations of black bears reported by non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1995-2013.

	2013[1]		2012[1]		2011[1]		2010[1]		2009[1]		2008[1]		2007[1]		2006[1]		2005[1]	
	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad
Total # Observed	12	18	3	34	2	27	0	29	3	14	8	48	4	34	2	27	4	21
% of Total Observed	40	60	8	92	7	93	0	100	18	82	14	86	11	89	7	93	16	84
No. Hunters Reporting	212	212	216	216	218	218	203	203	194	194	244	244	244	244	239	239	256	256
No. Hunters Saw at Least 1	4	13	1	7	2	19	0	8	3	10	3	10	2	17	1	14	3	18
Maximum # Observed	4	3	2	3	1	8	0	2	1	3	3	4	2	8	2	11	2	2

	2004[1]		2003[1]		2002[1]		2001		2000		1999		1998		1997		1996		1995[2]
	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	All Bears
Total # Observed	1	23	3	34	3	17	0	7	2	15	4	7	0	15	2	3	1	10	11
% of Total Observed	4	96	8	92	15	85	0	100	12	88	36	64	0	100	40	60	9	99	nil
No. Hunters Reporting	229	229	191	191	199	199	127	130	88	93	87	89	121	124	96	96	6	14	44
No. Hunters Saw at Least 1	1	19	2	21	2	14	1	7	1	10	2	6	0	8	2	3	1	9	9
Maximum # Observed	1	3	2	7	2	3	0	1	2	3	2	2	0	3	1	1	1	2	2

[1] Change in reporting for 2002 may have resulted in artificially lower numbers of hunters reporting for 1995-2001, see text.

[2] All bears not separated out by cubs and adults.

Grizzly Bear (*Ursus arctos*)

The Mackenzie Mountains have been closed to non-residents for hunting grizzly bears since 1982 and resident hunters have been restricted to one bear per lifetime since the same year (Veitch 1999). It is clear from hunter comments on voluntary observation forms that, despite the lack of hunting opportunities, grizzly bears in the Mackenzie Mountains remain a subject of considerable interest for non-resident hunters and their guides (Appendices C, D). As over the past 15 years, hunters in 2013 reported the loss of meat, capes and food to grizzly bears, and commented that there were too many grizzly bears and a hunt should be considered. Outfitters also continue to mention camp and equipment damage by grizzly bears both during and after the season. Even though moose calf numbers, based upon hunter observations, are generally lower in the Mackenzie Mountains than those reported in the Mackenzie Valley, and predation by grizzly bears could be a potential cause (Ballard 1992), there were few hunter comments indicating low moose or caribou calf numbers. A frequent comment of guided hunters is that bears have lost their fear of humans because of a lack of hunting and they were concerned that this was a human safety issue. Although there have been no documented injuries from grizzly bear attacks in the Mackenzie Mountains since the closure of the non-resident grizzly bear hunting season (Veitch 1999), there were three incidents in 2013 in the southern Mackenzie Mountains where grizzlies claimed either meat or hides from kills while guides were in the vicinity or while they were at camp. In most instances the grizzlies came at night, took the meat, and left without incident (Carl Lafferty personal communication). Since 1993 there have been 63 nuisance grizzly bears killed, the majority in the Sahtu (n=38) and Gwich'in (n=15) regions with ten in the Dehcho Region (ENR Norman Wells and Fort Simpson unpublished data). Two nuisance grizzly bear were killed this year, one in each of the Sahtu and Gwich'in regions of the Mackenzie Mountains. To minimize human-grizzly bear interactions electric fences have been used at main camps,

temporary camp use has been reduced, clean camp policy has become standard, and some known high-use grizzly bear areas have been avoided.

From 1996-2013, the number of adult grizzly bears observed annually has fluctuated around a mean of 305 (range 218-402), with no discenable trend over time (Figure 14, Table 20). The number of cubs observed annually has fluctuated more widely than that of adults around a mean of 77 (range 40-115), but also with no discernable trend over time (Figure 14, Table 20). Because cub grizzlies in the Mackenzie Mountains tend to stay with their mothers for three years (Miller et al. 1982), reported observations of 'cubs' likely refers to cubs-of-the-year, yearlings, and possibly two-year-old bears. This may account for some of that variability in our cub observations. The percent 'cubs' reported from 1996-2013 ranges from 12.4-29.0 (mean 19.9). Miller et al. (1982) estimated that cubs and yearlings made up 14.3 and 10.4%, respectively of the grizzly population during 1973-1977. If yearlings were reported as cubs this could explain the high range we report for observed 'cubs'.

Miller et al. (1982) documented a low reproductive rate for female grizzly bears in the Mackenzie Mountains, with no sows less than eight-years-old producing cubs, an average inter-litter interval of 3.8 years, and a mean litter size of 1.8. We estimated the mean litter size from hunter observation reports by analyzing just those observations of groups of grizzly bears where cubs were present with only one adult. The estimated mean litter size in 2013 was 1.4, which falls at the lower end of the range (1.4-2.0) reported from 1996-2013, is below the mean 1.8 found by Miller et al. (1982) in the Mackenzie Mountains from 1973-1977 and the 2.2 reported for grizzly bears of Kodiak Island, Alaska (Troyer and Hensel 1964).

We must be cautious when comparing our estimates of grizzy bear demographics from the Mackenzie Mountain with those of Miller et al. (1982). Miller et al (1982) conducted field research from 1973-1977 in a remote area of just 3,000 km^2 near the Yukon border. Although remote it was bisected by the Canol Road and encompassed small portions of three outfitting zones, S/OT/02, S/OT/03, and S/OT/04. At that time there was non-resident hunting of grizzly bears. Individual bears in the study area were captured, measured, marked, and collared with VHF collars, but they could only be relocated by aerial or ground-based means with locations marked on maps. We collect observation data from guides/hunters from all zones found throughout the Mackenzie Mountains. Non-resident hunting ceased in 1982. Although resident hunting still occurs, it is extremely limited. Therefore grizzly bears observed during 1996-2013 and the grizzly bear population have really not been exposed to human harvest for a generation. Nevertheless, over the past 20 years the number of bears observed and the number of 'cubs' observed (given the removal of 63 problem bears) has remained relatively stable (Figure 14).

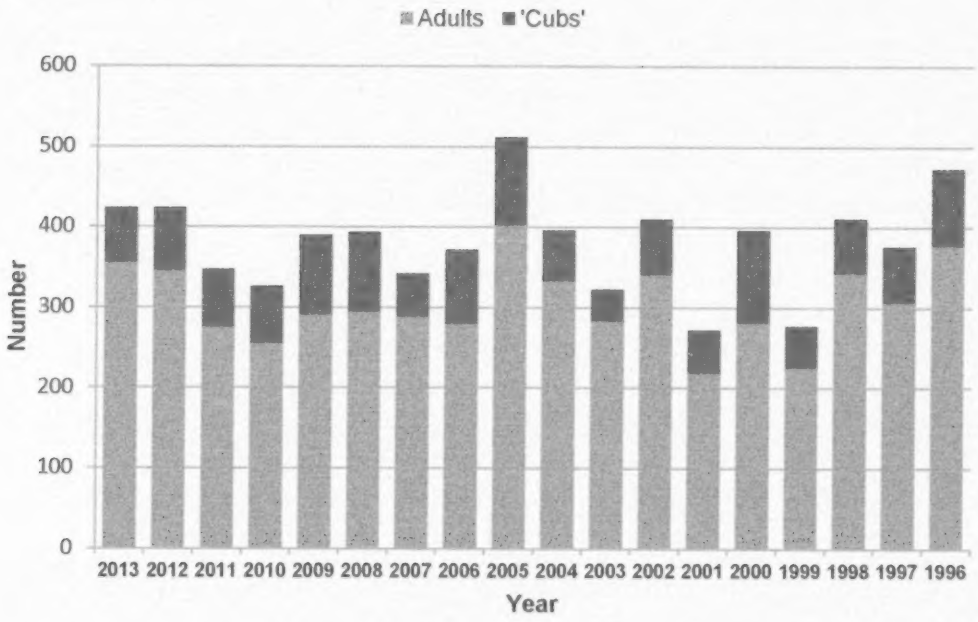


Figure 14: The number of adult and 'cub' grizzly bears observed by hunters from 1996-2013. Data are based upon voluntary hunter observation forms.

Table 20: Observations of grizzly bear reported by non-resident hunters in the Mackenzie Mountains, 1995-2013; total number of bears observed, % of cubs/adults, number of hunters reporting grizzly observations, number of hunters seeing at least one cub/adult, the mean and maximum number of cub/adults observed.

	2013		2012		2011		2010		2009		2008		2007		2006		2005	
	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad
Total # Observed	69	355	79	345	72	275	71	255	100	290	99	294	54	288	93	279	110	402
% of Total #	16	84	19	81	21	79	22	78	26	74	25	75	16	84	25	75	21	79
# Hunters reporting	29	123	46	138	38	123	33	104	47	109	48	139	28	127	50	122	49	150
# Hunters saw ≥1	20	74	24	71	28	65	25	53	36	64	31	64	17	56	32	70	10	65
Mean # Observed	2.4	2.9	1.7	2.5	1.9	2.2	2.2	2.5	2.1	2.7	2.1	2.1	1.9	2.3	1.9	2.3	2.0	2.3
Max. # Observed	6	15	5	14	4	10	5	11	6	20	6	12	5	15	5	12	10	16

	2004		2003		2002		2001		2000		1999		1998		1997		1996		1995
	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	All Bears[1]
Total # Observed	63	333	40	283	69	341	59	222	113	281	52	225	68	343	70	306	96	377	389
% of Total #	16	84	12	88	17	83	21	79	29	71	19	81	17	83	19	81	20	80	nil
# Hunters reporting	34	131	19	120	34	128	136	171	108	131	98	117	139	177	110	170	49	132	138
# Hunters saw ≥1	15	57	9	53	11	48	28	104	51	97	28	81	31	105	32	129	46	129	123
Mean # Observed	1.9	2.5	2.1	2.4	2	2.7	0.4	1.3	1.1	2.1	0.5	1.9	0.5	1.9	0.6	1.8	2.0	2.9	2.8
Max. # Observed	4	15	12	7	8	20	5	10	8	12	4	12	6	16	12	17	5	15	16

[1]All bears were not separated out by cubs and adults.

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APPENDIX A

Outfitters licenced to provide services to non-resident hunters in the Mackenzie Mountains, NWT – 2013.

D/0T/01 – SOUTH NAHANNI OUTFITTERS LTD.
Werner and Sunny Aschbacher
PO Box 31119
Whitehorse, YT Y1A 5P7
Ph: (867)-399-3194
Fx: (780)-665-7076
e-mail: huntnahanni@gmail.com
website : www.huntnahanni.com

D/0T/02 – NAHANNI BUTTE OUTFITTERS
Jim Lancaster
PO Box 3854
Smithers, BC VOJ 2N0
Ph: (250)-846-5309
2nd Ph: (250)-263-9197
e-mail: jladventures@xplornet.com
website: www.lancasterfamilyhunting.com

G/0T/01 – ARCTIC RED RIVER OUTFITTERS
Tavis Molnar
PO Box 1
Whitehorse, YT Y1A 5X9
Ph: (867)-633-4934
Fx: (867)-633-4934
e-mail: info@arcticred-nwt.com
website: www.arcticred-nwt.com

S/0T/01 – GANA RIVER OUTFITTERS
Harold Grinde
P.O. Box 528
Rimbey, AB T0C 2J0
Ph: (403)-357-8414
e-mail: ganariver@pentnet.net
website: www.ganariver.com

S/0T/02-MACKENZIE MOUNTAIN OUTFITTERS
Stan and Helen Stevens
P.O. Box 175
Dawson Creek, BC V1G 4G3
Ph: (250)-786-5118
Fx: (250)-786-5404
e-mail: mmostanstevens@gmail.com
website: www.mmo-stanstevens.com

S/0T/03 – RAM HEAD OUTFITTERS
Stan and Debra Simpson
P.O. Box 89
Warburg, AB T0C 2T0
Ph: (780)-848-7578
Fx: (780)-848-7550
e-mail: ramheadoutfitters@hotmail.com
website: www.ramheadoutfitters.com

S/0T/04 - NWT OUTFITTERS
Eric and Lorna Mikkelson
PO Box 106
Lazo, BC V9N 8Z8
Ph: (888)-293-2299
Fx: (250)-897-0054
e-mail: nwtoutfitters@shaw.ca
website: www.nwtoutfitters.com

S/0T/05 - REDSTONE TROPHY HUNTS
Dave Dutchik
P.O. Box 1172
Cochrane, AB T4C 1B2
Cell: (250)-261-9962
Ph/Fx: (403)-975-8862
e-mail: redstonehunts@yahoo.ca
website: www.redstonehunts.com

APPENDIX B

Summary of fees, bag limits, and seasons for big game species available to non-resident hunters in the Mackenzie Mountains, NWT - 2013. (Note: all prices are in Canadian funds.)

Species	Status	Tag Fee	Trophy Fee	Bag Limit	Season
Black Bear	Non-resident	$40.00	$200.00	1 adult bear not accompanied by a cub	15 Aug - 31 Oct
	Non-resident alien	$100.00	$200.00		15 Aug – 30 June
Woodland Caribou	Non-resident	$40.00	$400.00	1	25 Jul - 31 Oct
	Non-resident alien	$100.00	$400.00		
Mountain Goat	Non-resident	$40.00	$400.00	1	15 Jul - 31 Oct
	Non-resident alien	$100.00	$400.00		
Moose	Non-resident	$40.00	$400.00	1	1 Sep - 31 Oct
	Non-resident alien	$100.00	$400.00		
Dall's Sheep	Non-resident	$40.00	$400.00	1 adult male with min. ¾ curl	15 Jul - 31 Oct
	Non-resident alien	$100.00	$400.00		
Wolf	Non-resident	$40.00	$200.00	1 or 2[2]	25 Jul - 31 Oct
	Non-resident alien	$100.00	$200.00	2	1 Aug - 15 Apr
Wolverine	Non-resident	$40.00	$200.00	1	25 July - 31 Oct
	Non-resident alien	$100.00	$200.00		25 July - 31 Oct

Source: Department of Environment and Natural Resources. 2013. Northwest Territories Summary of Hunting Regulations. Department of Environment and Natural Resources, Yellowknife, NWT. 38 pp.

[2] One wolf limit from D/OT/01-02 and G/OT/01, and two wolf limit from S/OT/01-05.

APPENDIX C

Comments provided from non-resident hunters in the Mackenzie Mountains, NWT on voluntary Hunter Wildlife Observation Report forms, 2013. We have not printed actual names of outfitters or their guides (XXX).

Excellent experience with a truly professional outfitter in amazing scenic country.
Good hunt.
Saw a yearling ram with the old rams - very unusual.
It was a fantastic hunt, thank you for all!!!
Excellent outfit & guides!!!
Excellent outfit & guides!!!
Grizzly attacked four times and kept guide + hunters in a patch of willows till the helicopter saved them. Shots were fired but the bush was too heavy.
Killed a ram with gun + caribou with bow
Very professional all around from all aspects!
Awesome hunt! Trip of a lifetime - very enjoyable!!
Excellent Outfitter. Great memories. Lots of game.
Excellent
Enjoy a every moment of it. XXX, my guide has exceptional knowledge of wildlife.
All perfect.
Too many bears.
More communication.
Returned early, health issues.
Bow hunter, several stalks no luck.
Lots of game. Great Outfitter.
Very good experience!
I had a nice time and everything was great!
I feel strongly that the proposed park is a waste of a resource and inproper game management.
XXX is a beautiful man + great guide.
Good hunt/Lots of sheep.
Good time. Top of the line outfitter.
This is the second time I have hunted with XXX and plan to come back again. They are a first class outfitter with plenty of quality animals to hunt.
Hunt ended to quick.
Overall very good, plenty of game + great people + experience.
This area is well taken care of by the Outfitters. I will come back to hunt with them again in this area.
Outstanding experience. First rate outfitter & guide. Client has replaced hips and was forced to stop hunting after sheep hunt as he had reinjured one of his hips, rebooked again.
XXX is a first rate ethical operation.
The park expansion plan is a waste of great hunting opportunities.
I would really want to come back hunting this beautiful country and region. The hunt is organized the very best I have been with on all continents. We've told this area will become non-huntable, because its going to be a national park. That is a pitty, because the area will need hunters to control and manage the many different species. I hope you reconsider.

A very enjoyable hunt in the Mackenzie Mts. Game is very well managed and the outfitter was top-notch.
An outstanding experience with plenty of game sighted in a beautiful country. XXX have very knowledgeable, experienced guides that provide a hunt of a lifetime for me.
I drove here and took home the meat from a ram and a caribou.
Missed on his sheep hunt returning next season.
Very nice country. Wounded ram day 3 could not find ram. Hunt over.
I did not harvest a ram. Bow hunter.
Missed shots at sheep left early due to mother having health issues.
Outstanding area, outstanding outfitter. Missed shots left early due to family complications.
Bow hunter no harvest returning next season.
Older gentleman quit after 2 days of hunting, just too much for him.
Please consider allowing non-residents to hunt grizzly bears.
All animals fat and healthy.
Bad weather lots rain high water low lamb crop.
Good hard hunt, weather not so good. Animals looked healthy, low lamb count.
Good hard hunt, weather not so good. Animals looked healthy, low lamb count.
Focussed on sheep for the hunt and killed late not leaving time for caribou. The animals looked healthy and no obvious problems with ram harvested. If you're looking.
All animals were in great shape.
Seen lots of game, good weather.
Too damn many bears, extreme close encounter with young boar.
Seefood Chowder is the best mountain house for 2013..101.
"Cold" "Very cold" "buffalo chicken mountain house warms a guy up"
Rams very high, ewe/lamb ratio very high, healthy game, lots of critters.
Bad weather lots of caribou across creek.
Seen caribou across creek, bad weather.
Good hunt animals looked good hot weather.
Good hunt animals looked good hot weather.
Seen lots of game, couldn't travel far.
All animals in great shape.
Good hunt, bad weather, lots of snow, lots of griz.
All animals in great shape.
Had a wonderful time in your country and your province. Can't wait to return and experience more of its people and wildlife. See you next year!
Great hunting practices displayed by XXX in selecting older animals past their prime for breeding.
Excellent hunt, guides and outfitter exceptional.
great hunt - great stuff.
Excellent hunt, very professional operation with highly dedicated staff.
Excellent outfitter and operation will recommend and am returning in 2015.
XXX is a very well managed operation and provides positive and memorable experiences.
Over the 8 days I hunted, caribou sitting in 1 valley approximately 4 x 2 miles we saw 8 different grizzlies. I think it is about time the NWT revisits its resident only hunting policy not only for the sake of predation but as a benefit for tourism and your economy.These remote outfitting areas need better bear management.
Great hunt, great guides, very good equipment. Really first rate outfitter.

It was an archery hunt that took a day to find the animal - unfortunately the meat was spoiled beyond recovery.
Although my sighting of game was less than the norm, my overall experience was fantastic.
Great experience
Very nice trip.
Excellent experience, see yo soon.
Excellent accomodations meals, guides + service - overall an excellent and professional outfitting provider! However ENR requires to manage it's grizzly bear population!
Please provide me with a copy of the 2012 harvest report.
In ten years the grizzly bear population has definitely increased.
Great hunt! Great outfitter! + Great people + was XXX's cooking.
Excellent time!
A great experience of a lifetime. Great family owned outfitters.
To summarize this hunt with XXX! Stewardship, Ethics, Honor, Pride. I love these people. Canada should be proud…
Wonderful area, well organized - hard working outfit - good guides - good food - good camp.
Best hunting trip of my life.
Excellent hunting trip with an excellent outfitter.
You need a grizzly bear hunt.
Great operation and people
Too many grizzly bears, why is there no season????
Great time - have now shot moose, dall's sheep and caribou so will not return only because I feel I have hunted what I want to hunt.
Great outfitter - bad weather on most of the hunt. Did not harvest.
Awesome hunt. Great job. Keep hunting opportunities open. Be back next year.
Great outfitter, very ethical! Demonstrates fair chase and manages game by only taking mature rams.
Tore his knee.
All edible meat was hiked back to main camp. Fantastic Country! Worth coming over to see and hunt in.
Drove to Mile 222
Drove to Mile 222
Great hunt but very physical. Excellent outfitter and guide. Beautiful country.
Grizzly took 100 pds from camp.
Hunter shot wrong Ram
Drove to Mile 222.
Drove to Mile 222.
I really loved the view + all the surroundings.
Excellent/outstanding
Outstanding experience!!
Excellent, must open a grizzly bear hunt!!
Very well run organization. The meat harvest and handling was exceptional. The experience exceeded my expectations.
Grizzly hunt should be opened
Wonderful experience top notch in every aspect. Beautiful country that will never be forgotten.
Fantastic Hunt. Great outfitter, tremendous guides. Very happy with the hunt. Thanks.

XXXX, XXX and guide XXX + XXX did an excellent job all around. Very well organized, great hunting area and camps. I'll be back with my son!
Plenty of game, great wilderness.
From Russia, does not speak or read English.
First time to NWT, great animals, the quality was great. I will come back.
Lots of quality game, lots of animals and trophy game. Enjoyed the trip, will be back!
Only 5 rams spotted, only 1 ram over full curl.
I saw good amounts of caribou bulls & cows. Observing the black bears was amazing.
All animals seen were in good condition, quantity was good too. Seeing track & hearing from other hunters in camp, NWT should consider a grizzly season.
Good numbers
Good quality, lots of animals
Good hunt, great country. Good size moose
Great experience every time. I do think this place is never going to be over hunted, plenty of game, very good wildlife management, congrats.
Beautiful country and lots of game.
Everything looks great!
Always enjoy this country
Excellent quantity and quality, fewer calves than expected.
Saw large numbers of caribou each day afield - all animals appeared healthy and in good condition.
No unusual conditions on the animal harvested.
Great camp-great guides, beautiful views-plenty of game-very good folks to hunt with-
Hope to bring my grandson on a hunt of a life time. I saw a lot of caribou, was well pleased with the healthy herds, conditions of the game was great! Proud to harvest the great bull I got.
Letter attached explaining about a wounded caribou.
Great area, nice scenery.
If I return to Mackenzie to hunt it will be with a different outfitter. I believe XXX is over hunting the Dall's sheep in parts of their area.

APPENDIX D

A summary of the 2013 voluntary hunter comments broken down into specific topics.

No. of Hunters Reporting	No. of Hunters Mentioning Good Quality Hunts	No. of Hunters Mentioning Abundance /Quality of Animals	No. of Hunters Mentioning Grizzlies	No. of Hunters Mentioning Wolves	No. of Hunters Mentioning Park Expansion	No. of Hunters Mentioning Bad Weather
133	77	39	15	0	3	7

APPENDIX E

Number, age, and horn length measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1967-2013. Number harvested includes 10[1], 2[2], 6[3], 8[4], 7[5], 9[6], 4[7] and 11[8] harvested by resident hunters.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean (cm)	Sample Size
1967-1968	223	8.4	Unknown	86.4	168
1969	110	-	-	-	-
1970	94	-	-	-	-
1971	88	-	-	-	-
1972	110	8.5	96	86.2	90
1973	89	8.9	86	84.4	88
1974	93	9.2	85	88.6	91
1975	129	7.6	67	84.6	127
1976	144	7.8	46	88.0	144
1977	132	5.7	69	86.8	132
1978	187	8.5	115	88.9	165
1979	200	8.7	108	90.8	154
1980	188	-	-	90.1	127
1981	183	8.1	101	92.7	157
1982	126	8.7	98	89.7	124
1983	100	9.0	80	90.9	94
1984	102	8.4	98	91.2	99
1985	123	8.1	115	89.7	112
1986	154	8.8	132	88.4	153
1987	148	8.9	148	89.4	148
1988	177	9.8	166	91.7	161
1989	207	9.9	199	90.4	203
1990	219	9.8	200	90.2	218
1991	170	9.7	161	89.1	170

APPENDIX E (CONT.)

Number, age, and horn length measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1967-2013. Number harvested includes 10[1], 2[2], 6[3], 8[4], 7[5], 9[6], 4[7] and 11[8] harvested by resident hunters.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean	Sample Size
1992	203	9.7	199	88.0	202
1993	191	9.7	181	87.6	190
1994	199	9.5	191	89.8	196
1995	189	9.6	189	88.9	189
1996	201	9.5	200	88.7	201
1997	210	10.0	206	89.9	203
1998	215	10.0	207	90.0	209
1999	204	10.2	183	88.8	184
2000	194	10.0	188	88.9	188
2001	199	10.1	183	87.7	184
2002	173 [6]	9.9	166	89.2	166
2003	213 [3]	9.7	210	89.8	212
2004	201 [1]	10.0	199	89.3	200
2005	203 [7]	10.2	196	89.4	199
2006	208 [8]	10.4	206	88.4	207
2007	216 [3]	10.8	216	88.3	216
2008	192 [4]	10.6	192	88.8	192
2009	179 [5]	10.9	178	88.2	178
2010	193 [6]	10.8	191	88.7	192
2011	181 [7]	10.8	181	90.5	181
2012	207 [6]	10.9	205	89.9	206
2013	193 [4]	10.5	193	87.5	193
Mean 1972-2013	**174**	**9.5**	**157**	**89.0**	**168**

APPENDIX F

Outfitted non-resident hunter harvests in the Mackenzie Mountains, 1991-2013. Number harvested includes 10[1], 2[2], 6[3], 8[4], 7[5], 9[6], 4[7] and 11[8] harvested by resident hunters.

Year	Number of Licences Sold	Number of Animals Harvested						
		Dall's Sheep	Mountain Caribou	Moose	Mountain Goat	Wolf	Wolverine	Black Bear
1991	354	170	179	40	6	14	3	1
1992	364	203	142	32	4	7	0	0
1993	382	191	191	56	9	7	3	0
1994	356	199	164	46	5	15	2	0
1995	344	189	180	49	6	14	1	0
1996	387	201	175	46	4	9	4	0
1997	352	210	168	44	2	17	1	0
1998	345	215	160	52	5	9	0	0
1999	321	204	117	36	1	11	3	0
2000	332	194	127	44	1	14	0	0
2001	332	199	128	41	2	15	2	0
2002	338	173[6]	168	42	5	11	1	0
2003	350	213[3]	143	48	6	12	0	0
2004	347	201[1]	135	55	6	18	0	0
2005	398	203[7]	160	75	18	19	1	0
2006	418	208[8]	188	72	12	23	1	0
2007	405	216[3]	165	74	21	12	0	0
2008	399	192[4]	167	75	21	17	1	2
2009	339	179[5]	125	59	20	20	3	1
2010	384	193[6]	158	75	13	19	3	0
2011	400	181[7]	181	78	20	21	2	1
2012	405	207[6]	168	85	12	24	0	0
2013	409	193[4]	182	81	11	16	2	0
Mean 1991-2013	**368**	**197**	**160**	**57**	**9**	**15**	**1**	**0**

APPENDIX G

Summary of age and sex ratios calculated from non-resident hunter observation reports in the Mackenzie Mountains, 1995-2013.

Year	Dall's Sheep		Mountain Caribou		Moose	
	Lambs: 100 Ewes	Rams: 100 Ewes	Calves: 100 Cows	Bulls: 100 Cows	Calves: 100 Cows	Bulls: 100 Cows
1995	67	82	36	34	30	95
1996	44	82	45	40	26	76
1997	57	55	36	21	30	107
1998	60	84	35	34	30	95
1999	58	90	43	25	20	100
2000	47	90	41	39	26	89
2001	59	89	56	61	28	120
2002	58	89	59	31	29	96
2003	50	83	39	36	25	129
2004	53	93	42	38	30	101
2005	51	98	42	42	33	110
2006	53	96	43	37	33	137
2007	64	83	52	37	36	101
2008	49	98	41	40	31	115
2009	55	94	45	39	31	90
2010	49	93	45	46	35	101
2011	56	91	44	35	33	123
2012	53	86	40	46	33	88
2013	52	92	36	43	29	106
Mean 1995-2013	**54**	**88**	**43**	**38**	**30**	**104**

APPENDIX H

Summary of age and sex ratios calculated from non-resident hunter observation reports of mountain goats, 2002-2013.

Year	Kids:100 Nannies	Billies:100 Nannies	Total Animals
2002	55.2	75.9	69
2003	61.5	70.5	182
2004	57.1	77.1	84
2005	66.0	50.4	306
2006	61.5	51.4	245
2007	71.2	57.7	393
2008	54.3	97.1	264
2009	64.6	59.0	327
2010	78.3	46.2	239
2011	64.0	59.0	243
2012	51.8	71.9	257
2013	69.6	75.0	144
Mean	**62.9**	**65.9**	**229.4**